XI vols XXIII - XXXIII
XXXIV - XXXV

II
13

381

PROCEEDINGS

OF THE

DORSET NATURAL HISTORY

AND

ANTIQUARIAN FIELD CLUB.

EDITED BY

W. MILES BARNES.

VOLUME XXIII.

Dorchester:

PRINTED AT THE "DORSET COUNTY CHRONICLE" OFFICE.

1902

J. C. MANSEL-PLEYDELL, D.L., F.L.S., F.G.S., &C.,

ESIDENT OF THE DORSET NATURAL HISTORY AND ANTIQUARIAN FIELD CLUB, 1875-1902.

DIED MAY 3RD, 1902.

CONTENTS.

INDEX TO PLATES, ENGRAVINGS, &c.

NOTICES.

The Rules have not been reprinted in this volume; the only change made in them is by the omission of the words "one year" in Rule 10.

THE PLATE FUND.

The Executive desire to call the attention of the Members of the D.F.C. to the existence of a "Plate Fund" for defraying the very heavy expense of the Illustrations in the volumes of Proceedings. In some cases the writer generously presents the engravings; but, in order to maintain the high standard of excellence attained by recent volumes, without again incurring so deep an obligation to an individual Member, a special contribution would be extremely valuable.

Donations to the Plate Fund.

	s.	d.
W. P. Curtis, Esq.	1	0
C. S. Prideaux, Esq.	5	0
W. H. Bond, Esq.	10	0

Special Donations of Plates, Printing, &c., towards Volume XXIII.

From Henry Storks Eaton, Esq.:

The cost of printing the Return of the Rainfall in Dorset.

From W. H. Hudleston, Esq.:

The plates and blocks from which the prints have been produced which illustrate his paper on Creechbarrow.

NOTICE BY HON. TREASURER.

VOLS. OF PROCEEDINGS.

There are found to be a few complete sets of back numbers of Field Club Proceedings in the Treasurer's hands for disposal at the following rates, to Members only:—

		£	.	d.
A.	Complete set of 20 vols. at 7s.	7	0	0
B.	Half set of 10 later vols. at 8s	4	0	0
C.	Quarter set of 5 later vols. at 9s.	2	5	0

Separate Vols. 10s. each, except copies of the scarce early Vols. I.—IV. inclusive, which are 12s. each. All applications must be prepaid, and will be dealt with in order of priority; of two or more simultaneous applications the larger order will take precedence.

Copies of the General Index to the first 16 volumes of Proceedings can be obtained at 6d. each.

The Dorset Natural History and Antiquarian Field Club.

INAUGURATED MARCH 26th, 1875.

President:

THE LORD EUSTACE CECIL, F.R.G.S.

Vice-Presidents:

VAUGHAN CORNISH, ESQ., D.SC., F.C.S., F.R.G.S.
CAPTAIN G. R. ELWES (*Hon. Treasurer*).
W. H. HUDLESTON, ESQ., M.A., F.R.S., F.L.S., F.G.S.
REV. O. PICKARD-CAMBRIDGE, M.A., F.R.S.
H. COLLEY MARCH, ESQ., M.D., F.S.A., M.R.S.H.I., F.A.I.
NELSON M. RICHARDSON, ESQ., B.A., F.E.S.
HON. MORTON G. STUART-GRAY, F.G.S.

Hon. Editor:

W. MILES BARNES, Monkton Rectory, Dorchester.

Executive Body:

The Lord EUSTACE CECIL, F.R.G.S. (*President*).
H. COLLEY MARCH, Esq., M.D., F.S.A., M.R.S.H.I., F.A.I. (*Hon. Secretary.*)
Captain G. R. ELWES (*Hon. Treasurer*), Bossington, Bournemouth.

Honorary Members:

W. CARRUTHERS, Esq., F.R.S., F.G.S., F.L.S., British Museum (Nat. Hist.), South Kensington.
Rev. OSMOND FISHER, M.A., F.G.S., &c., Harlton Rectory, Cambridge.
A. J. JUKES-BROWNE, Esq., F.G.S., 28, Jermyn Street, London, S.W.
R. LYDEKKER, Esq., F.R.S., The Lodge, Harpenden, Herts.
ALFRED NEWTON, Esq., M.A., F.R.S., Professor of Zoology and Comparative Anatomy, Magdalen College, Cambridge.
CLEMENT REID, Esq., F.R.S., 28, Jermyn Street, London, S.W.
A. SMITH-WOODWARD, Esq., F.G.S., British Museum (Nat. Hist.), South Kensington, London.
Mr. A. M. WALLIS, 29, Mallams, Portland.

LIST OF MEMBERS

OF THE

Dorset Natural History & Antiquarian Field Club.

The Right Reverend the Lord Bishop of Salisbury, D.D.	The Palace, Salisbury
The Right Reverend the Bishop of Southwark, D.D.	Dartmouth House, Blackheath Hill, London S.E.
The Right Hon Viscount Portman	Bryanston, Blandford
The Right Hon. Lord Eustace Cecil	Lytchett Heath, Poole
The Right Hon. Lord Digby	Minterne, Dorchester
The Right Hon. Lord Stalbridge	Motcombe House, Shaftesbury
The Right Hon. Lord Walsingham	Merton Hall, Thetford, Norfolk
Acland, Captain John E.	Wollaston House, Dorchester
Acton, Rev. Edward	Iwerne Minster Vicarage, Blandford
Aldridge, Mrs. Selina	Shirley, Dorchester Road, Weymouth
Allen, George, Esq.	Strangways, Marnhull, Blandford
Allhusen, Wilton, Esq.	Clevelands, Lyme Regis
Anthony, Rev. E. Solly	Almondbury, Poole
Baker, E. Whitley, Esq.	Glencairn, Wimborne
Bankes, W. Albert, Esq.	Wolfeton House, Dorchester
Bankes, Eustace Ralph, Esq.	Norden House, Corfe Castle, Wareham
Bankes, Rev. Canon Eldon S., M.A.	The Close, Salisbury
Bankes, W. Ralph, Esq.	Kingston Lacy, Wimborne
Barnes, Mrs. John Iles	Summer Hayes, Blandford
Barnes, Rev. W. M., B.A., R.D.	Monkton Rectory, Dorchester
Barrett, W. Bowles, Esq., F.L.S.	Weymouth
Bartelot, Rev. R. G., M.A.	Church House, Salisbury
Baskett, Rev. C. R.	Birstwith Vicarage, Ripley, Leeds
Baskett, S. R., Esq.	Evershot
Bassett, Rev. H. H. T.	Houghton Rectory, Blandford
Batten, Colonel Mount	Mornington Lodge, West Kensington, London
Batten, H. B., Esq.	Aldon, Yeovil

Beckford, F. J., Esq.	Witley, Parkstone
Beesley, Rev. T. B.	Chesilborne Rectory, Dorchester
Bellasis, W. Dalglish, Esq.	4, Cromwell Place, London
Bond, N., Esq.	Holme, Wareham
Bond, Wm. H., Esq.	Tyneham, Wareham
Bonsor, Geo., Esq.	Seaborough Court, Crewkerne
Bower, H. Syndercombe, Esq.	Fontmell Parva, Shillingstone, Blandford
Bower, Rev. Charles H. S., M.A.	Hinton St. Mary, Sturminster Newton, Dorset
Bowker, James, Esq.	Junior Conservative Club, Albermarle Street, London
Bowles, Lieut.-Colonel	Shoeburyness
Brandreth, Rev. F. W., M.A.	Buckland Newton, Dorchester
Brennand, John, Esq.	Belmont, Parkstone
Brennand, W. E., Esq.	Blandford
Brough, Colonel W., R.H.A.	Parsonage Farm House, Fordington, Dorchester
Brown, J., Esq.	Maiden Newton
Brown, Miss	Belle Vue, Shaftesbury
Browning, Benjamin, Esq., M.D.	Royal Terrace, Weymouth
Brymer, Rev. J. G., M.A.	Childe Okeford Rectory, Blandford
Bullen, Colonel John Bullen Symes	Catherston, near Charmouth
Burt, Miss Emma	Purbeck House, Swanage
Busk, W., Esq.	West Walks, Dorchester
Bussell, Miss Catharine	Thorneloe, Bridport
Butts, Captain	The Salterns, Parkstone, Dorset
Carter, William, Esq.	The Heritage, Parkstone
Chadwick, Mrs.	Chetnole, Sherborne
Chudleigh, Rev. R. Augustine, M.A.	West Parley Rectory, Wimborne
Chudleigh, Mrs.	West Parley Rectory, Wimborne
Chudleigh, Miss W. M.	West Parley Rectory, Wimborne
Church, Colonel Arthur	St. Alban's, Rodwell, Weymouth
Clarence, Lovell Burchett, Esq.	Coaxden, Axminster
Clarke, R. Stanley, Esq.	River House, Tillington, Petworth
Climenson, Rev. John	Shiplake Vicarage, Henley-on-Thames
Colfox, Miss A. L.	Westmead, Bridport
Colfox, T. A., Esq.	Coneygar, Bridport
Colfox, W., Esq., B.A.	Westmead, Bridport
Cornish, Vaughan, Esq., D.Sc., F.C.S., F.R.G.S.	72, Princes Square, London, W.
Cother, Rev. P. S.	1, Clearmount, Weymouth
Cox, Henry, Esq., F.S.A., F.R.G.S. M.G.S., &c.	Radipole Manor, near Weymouth
Crallan, J. G., Esq., M.B.	Bodorgan Manor, Bournemouth

Crespi, Dr. A. J. H.	Wimborne
Crickmay, G. R., Esq.	Weymouth
Cross, Rev. J.	Baillie House, Sturminster Marshall, Wimborne
Cull, James, Esq.	47, Phillimore Gardens, Campden Hill, London, W.
Cunnington, Edward, Esq.	Alma House, Weymouth
Curme, Decimus, Esq.	Childe Okeford, Blandford
Curtis, C. H., Esq.	Blandford
Curtis, Wilfrid Parkinson, Esq.	Aysgarth, Parkstone Road, Poole
Dale, C. W., Esq.	Glanvilles Wootton, Sherborne
Darell, D., Esq., F.G.S., F.L.S., F.Z.S.	St. Stephens, Plympton, Devon
Dansey, Miss S. J. T.	Lindisfarne, Weymouth
Davis, Geo., Esq.	Dorchester
Digby, J. K. D. W., Esq., M.P.	Sherborne Castle
Du Boulay, Mrs.	2, Royal Terrace, Weymouth
Dundas, Ven. Archdeacon	Charminster Vicarage, Dorchester
Eaton, Henry S., Esq.	The National Club, 1, Whitehall Gardens, London, S.W.
Edwards, Miss Sarah Powell	Penbryn, Weymouth
Elwes, Captain G. R. *(Vice-President and Hon. Treasurer)*	Bossington, Bournemouth
Erle-Drax, W. S., Esq.	Ollantigh Towers, Wye, Kent
Evans, Rev. Canon	St. Alphege, Parkstone, Dorset
Falkner, C. G., Esq.	The College, Weymouth
Farley, Rev. H.	Lytchett Minster, Poole
Farrer, Oliver C., Esq.	Binnegar Hall, Wareham
Ferguson, Colonel C. J. O'n.	The Dindors, Spa Road, Weymouth
Filleul, Rev. S. E. V.	All Saints' Rectory, Dorchester
Filliter, Freeland, Esq.	Wareham
Filliter, George Clavell, Esq.	St. Martin's House, Wareham
Filliter, Rev. W. D.	East Lulworth Vicarage
Fisher, Mrs.	Whitecroft, Buxton, Weymouth
Fletcher, W. H. B., Esq.	Aldwick Manor, Bognor, Sussex
Fletcher, W. J., Esq.	The Chantry, Wimborne
Floyer, G. W., Esq.	West Stafford, Dorchester
Forbes, Mrs.	Shillingstone, Blandford
Forde, Henry, Esq.	Luscombe, Parkstone
Forrester, Hugh Carl, Esq.	St. John's Cottage, Shaftesbury
Forrester, Mrs.	Bryanston, Blandford
Freame, R., Esq.	The Chantry, Gillingham
Fry, Edward Alexander, Esq.	172, Edmund Street, Birmingham
Fullaway, Mrs.	Sturminster Newton
Fyler, J. W. T., Captain	Hethfelton, Wareham

Gallwey, Captain E. Payne	Rodwell, Weymouth
Galpin, G., Esq.	Clarendon Court, Clarendon Road, Bournemouth
George, C. E. A., Esq.	Fleet House, near Weymouth
George, Mrs.	Fleet House, near Weymouth
Girdlestone, Mrs.	Langton Herring Rectory, Dorchester
Glyn, Captain Carr Stuart	Wood Leaze, Wimborne
Glyn, Lieut.-General J. P. Carr	Uddens, Wimborne
Glyn, Sir R. G., Bart.	Gaunts House, Wimborne
Godman, F. du Cane, Esq., F.R.S.	South Lodge, Lower Beeding, Horsham
Gorringe, Rev. P. R., M.A.	Manston Rectory, Blandford
Greves, Hyla, Esq., M.D.	Rodney House, Bournemouth
Griffin, F. C. G., Esq., M.B.	Royal Terrace, Weymouth
Groves, T. B., Esq.	Broadley, Westerall, Weymouth
Groves, W. E., Esq.	Dorchester
Hadow, Rev. J. L. G., M.A.	18, Royal Terrace, Weymouth
Haggard, Rev. H. A., M.A.	Pine Hurst, Bournemouth
Hall, Chas. Lillington, Esq.	Osmington Lodge, Osmington, Weymouth
Hankey, Rev. Canon Montagu, M.A.	Maiden Newton Rectory, Dorchester
Hansford, Charles, Esq.	Dorchester
Hardwick, Stewart, Esq.	21, Commercial Road, Bournemouth
Harrison, Rev. F. T., M.A.	Burton Bradstock Rectory, Bridport
Harston, Comdr. F. A. (late R.N.)	Newlands, Glendenning Avenue, Weymouth
Hart-Dyke, Rev. Canon P., M.A.	Lullingstone, Wimborne
Hasluck, Rev. Ernest, M.A.	Handley Vicarage, Salisbury
Hassell, Miss	Westfield Lodge, Parkstone
Hawkins, W., Esq.	Broadway, Dorchester
Hayne, R., Esq.	Fordington House, Dorchester
Head, J. Merrick, Esq.	Pennsylvannia Castle, Portland
Henning, Mrs.	Frome, Dorchester
Hibbs, Geo., Esq.	Bere Regis, Wareham
Highton, Rev. E., M.A.	Tarrant Keynston Rectory, Blandford
Hill, R. E., Esq.	Long Lynch, Shillingstone
Hine, R., Esq.	Beaminster
Hogg, B. A., Esq.	Dorchester
Wood-Homer, Miss E. C.	Bardolf Manor, Puddletown
Honeywell, F., Esq.	Hilfield Estate, Byfleet Corner, Surrey
House, Edward, Esq.	Tomson, Blandford
Howard, Sir R. N.	Weymouth
Hudleston, W. H., Esq., F.R.S.	West Holme, Wareham
Huntley, H. E., Esq.	Charlton House, Blandford
Hurdle, H. A., Esq.	2, Frederick Place, Weymouth
Hussey, Rev. J.	Pimperne Rectory, Blandford
Kerr, E. W. Esq., M.D.	South Street, Dorchester

Kettlewell, Geo. Douglas, Esq.	Eagle House, Blandford
Lafontaine, Alfred C. de, Esq.	Athelhampton, Dorchester
Lange, Mrs. R. M. de	Winterfold, Broadstone
Langford, Rev. Canon	Belle Vue, Higher Hove, Plymouth
Leach, J. Comyns, Esq., M.D.	The Lindens, Sturminster Newton, Blandford
Leeds, Oglander, Esq.	The Cottage, Bridport
Lee, W. H. Markham, Esq., I.S.M.	Wyke Regis, Weymouth
Legge, Miss Jane	Allington Villa, Bridport
Le Jeune, H., Esq.	St. Ives, Upper Parkstone, Dorset
Leslie, Rev. E. C., M.A.	Came Rectory, Dorchester
Linklater, Rev. Robert, D.D.	Stroud Green Vicarage, London, N.
Lister, Arthur, Esq.	High Cliffe, Lyme Regis
Lister, Miss Guilelma	High Cliffe, Lyme Regis
Littledale, T. A. R., Esq.	11, Greenhill, Weymouth
Lock, Mrs. A. H.	53, High West Street, Dorchester
Lock, B. F., Esq.	11, New Square, Lincoln's Inn, London
Lock, Miss Mary C.	53, High West Street, Dorchester
Lonsdale, Rev. J. H.	Fontmell Magna, Shaftesbury
Lush, Wm. Vaudrey, Esq., M.D., F.R.C.P.	12, Frederick Place, Weymouth
Lush, Mrs.	12, Frederick Place, Weymouth
Lynes, Rev. John	Percy House, Wimborne
Lys, F. D., Esq.	2, Lorne Villas, Rodwell, Weymouth
Macdonald, P. W., Esq., M.D.	County Asylum, Dorchester
Mainwaring, Lt.-Col. F. G. L.	Wabey House, Upwey
Manger, A. T., Esq.	Stock Hill, Gillingham
Mansel-Pleydell, Mrs.	Whatcombe, Blandford
Mansel-Pleydell, Rev. J. C.	Sturminster Newton Vicarage, Blandford
March, H. Colley, Esq., M.D., F.S.A., Vice-President and Hon. Sec.	Portesham, Dorchester
Marriott, Sir W. Smith, Bart.	The Down House, Blandford
Martin, Miss Eileen	4, Greenhill, Weymouth
Mate, William, Esq.	Hornehurst, Alum Chine Road, Bournemouth West
Maude, W., Esq., B.C.L.	Brackenwood, Bournemouth
Maunsell, Rev. F. W.	Symondsbury Rectory, Bridport
Mayo, Rev. Canon C. H.	Longburton Vicarage, Sherborne
Mead, Miss	5, Brunswick Terrace, Weymouth
Middleton, H. B., Esq.	Bradford Peverell, Dorchester
Middleton, Miss L. M.	Lulworth
Miller, Rev. J. A., B.D.	Northfleet, Bexhill-on-Sea
Milne, Rev. Percy H., M.A.	Evershot Rectory, Dorchester
Moorhead, J., Esq., M.D.	1, Royal Terrace, Weymouth

Morrice, G. G., Esq., M.D.	17, Royal Terrace, Weymouth
Morton, Miss	14, Victoria Terrace, Weymouth
Moule, H. J., Esq., M.A.	The County Museum, Dorchester
Moullin, Arthur D., Esq.	Fermain, Parkstone
Murray, Rev. R. P., M.A., F.L.S.	Shapwick Rectory, Blandford
Okeden, Colonel U. E. Parry	Turnworth, Blandford
Palmer, Colonel R. H.	8, Clydesdale Mansions, Clydesdale Road, London, W.
Pass, Alfred C., Esq.	Hawthornden, Clifton Down, near Bristol
Patey, Miss	Saxilby Vicarage, Lincoln
Payne, Miss Eleanor	13, Greenhill, Weymouth
Payne, Miss Florence	Rydall, Wimborne
Pearson, W. E., Esq.	4, Westerhall Villas, Weymouth
Peck, Gerald R., Esq.	Sandacres, Parkstone
Penny, Rev. J., M.A.	Tarrant Rushton Rectory, Blandford
Pentin, Rev. H., M.A., F.R. Hist. Soc.	Milton Abbas Vicarage, Blandford
Perkins, Rev. T.	Turnworth Rectory, Blandford
Peto, Sir Henry, Bart.	Chedington Court, Misterton, Crewkerne
Phillips, Mrs.	Okeford Fitzpaine, Blandford
Philpot, J. E. D., Esq.	Holme Cleve, Lyme Regis
Philpots, John R., Esq., L.R.C.P. and S. Ed., J.P.	Moorcroft, Parkstone
Pickard-Cambridge, A. W., Esq.	Balliol College, Oxford
Pickard-Cambridge, Mrs.	10, Gloucester Row, Weymouth
Pickard-Cambridge, Rev. O., M.A., F.R.S.	Bloxworth Rectory, Wareham
Pike, T. M., Esq.	c/o Miss Pike, Wellington Court, Hyde Park, W.
Pond, S., Esq.	Blandford
Ponting, Chas. E., Esq., F.S.A.	Wye House, Marlborough
Pope, A., Esq.	South Court, Dorchester
Pope, George, Esq.	Bourne Hall, Bournemouth
Prideaux, C. S., Esq.	32, High West Street, Dorchester
Prideaux, W. de C., Esq.	32, High West Street, Dorchester
Pye, William, Esq.	Dunmore, Rodwell, Weymouth
Radclyffe, Eustace, Esq.	Hyde, Wareham
Ralls, James, Esq.	Bridport
Ravenhill, Rev. Canon H. E., M.A., R.D.	Buckland Newton Vicarage, Dorchester
Reeve, Mrs. Henry	Rutland Gate, London, W.
Rendell, W. F., Esq.	Hallow Dene, Parkstone
Reynolds, Mrs. Arthur	Westland, Bridport
Richardson, N. M., Esq., B.A., F.E.S. *(Vice-President)*	Montevideo, Chickerell, near Weymouth

Ridley, Rev. O. M.	East Hill, Charminster, Dorchester
Ridley, Rev. J.	The Rectory, Pulham, Dorchester
Rixon, W. A., Esq.	Alfoxton Park, Holford, Bridgwater
Robinson, Sir Charles, F.S.A.	Newton Manor, Swanage
Robinson, Vincent, Esq.	Parnham, Beaminster
Rodd, Edward Stanhope, Esq.	Chardstock House, Chard
Rooper, T. G., Esq.	Pen Selwood, Bournemouth
Ruegg, L. H., Esq.	Westbury, Sherborne
Russell, Colonel C. J., R.A.	Clavinia, Weymouth
Schuster, Rev. W. P., M.A.	Vicarage, West Lulworth
Schofield, F., Esq., M.D.	Windermere, Spa Road, Weymouth
Searle, Allan, Esq.	Wilts and Dorset Banking Company, Southampton
Sells, Rev. Alfred, M.A.	Bodorgan Manor, Bournemouth
Shearman, John, Esq.	Peveril House, Swanage
Shephard, Colonel C. S.	Shortlands, Osmington
Shepheard, T., Esq.	Kingsley, Bournemouth
Sherren, J. A., Esq.	Weymouth
Simpson, Jas., Esq.	Minterne Grange, Parkstone
Simpson, Miss	12, Greenhill, Weymouth
Slater, Robert, Esq., F.G.S.	Waverley, Swanage
Smith, Howard Lyon, Esq., L.R.C.P.	Buckland House, Buckland Newton, Dorchester
Snook, S. P., Esq., M.R.C.S. Engld., L.R.C.P. Lond.	20, Trinity Road, Weymouth
Solly, Rev. H. S., M.A.	Bridport
Sotheby, Rev. W. E. H., M.A.	Bere Regis Vicarage, Wareham
Sowter, Rev. F. B	Clevedon Lodge, Wimborne
Stephens, W. L., Esq.	West Bay, Bridport
Stone, Walter Boswell, Esq.	Bardwell Road, Oxford
Storer, Lieut.-Colonel, late R.E.	Keavil, Bournemouth
Stopford, Admiral	Shroton House, Blandford
Stroud, Rev. J., M.A.	South Perrott, Crewkerne
Stuart-Gray, Hon. Morton G.	2, Belford Park, Edinburgh
Sturdy, Leonard, Esq.	Trigon, Wareham
Sturdy, Philip, Esq.	The Wick, Branksome, near Bournemouth
Sturt, W. Neville, Esq.	India Office, London, S.W.
Sumner, Heywood, Esq.	Skerryvore, Bournemouth West
Suttill, H. S., Esq.	Pymore, Bridport
Swift, B. R., Esq.	45, South Street, Dorchester
Sydenham, David, Esq.	Bournemouth
Sykes, Ernest R., Esq.	3, Gray's Inn Place, Gray's Inn, London, W.C.
Symes, G. P., Esq.	11, Victoria Terrace, Weymouth

Taylor, J. Herbert, Esq.	Grayrigg, Parkstone
Telford-Smith, Telford, Esq., M.D.	Romansleigh, Wimborne
Tennant, Major-General	8, Belvedere, Weymouth
Thompson, Rev. G.	Highbury, Bodorgan Road, Bournemouth
Thurlow, Rev. Alfred R.	16, Great George Street, Weymouth
Tomson, Arthur, Esq.	Sydling St. Nicholas, Dorchester
Troyte-Bullock, Mrs.	North Coker, Yeovil
Turner, W., Esq.	42, High Street, Poole
Udal, The Hon. Chief Justice	33, Beverley Road, Anerley, London, S.E.
Usher, Rev. R., M.A., F.L.S.	West Knoyle Rectory, Bath
Usherwood, Rev. Canon T. E., M.A.	Rossmore, Parkstone
Vawdrey, Mrs.	Dorchester Road, Weymouth
Vosper-Thomas, Rev. A. F. C.	St. Luke's, Bilston, Staffordshire
Vosper-Thomas, Rev. S.	Moxley, Wednesbury, Staffordshire
Walker, Rev. S. A., M.A.	Spetisbury Rectory, Blandford
Ward, Rev. J. H.	Silverton Rectory, near Exeter, Devon
Warre, Rev. Canon F., M.A.	Bemerton Rectory, Salisbury
Watson, Rev. C. O., M.A.	The Vicarage, Bothenhampton, near Bridport
Watts, Rev. Sub-Dean Canon R. M.A.	Salisbury
Waugh, Rev. W. R., F.R.A.S.	Rosslyn Villa, Spring Gardens, Portland
Weaver, Rev. F. W., F.S.A.	Milton Vicarage, Evercreech, Somerset
Webb, E. Doran, Esq., F.S.A.	Gaston, Tisbury, Wilts
Whitby, Joseph, Esq.	Preston, Yeovil
Wilkinson, H. A., Esq.	Maiden Castle House, Dorchester
Wilkinson, Rev. J. H.	Melcombe Bingham Rectory, Dorchester
Williams, E. W., Esq.	Herringston, Dorchester
Williams, Miss	Osmington House, Weymouth
Williams, Robert, Esq., M.P.	Bridehead, Dorchester
Williams, Mrs. Robert	Bridehead, Dorchester
Woodhouse, Miss	Chilmore, Ansty, Dorchester
Workman, J. Reece, Esq., C.E.	Catherington, Millbrook, Southampton
Wright, Rev. Herbert L., B.A.	Church Knowle Rectory, Corfe Castle
Yeatman, Mrs.	Treverbyn, Warminster
Yeatman, Miss E. F.	King's Stagg, Sturminster Newton
Young, E. W., Esq.	Dorchester

The above list includes the New Members elected up to October 1st, 1902.

New Members Elected since the Publication of the List contained in Vol. xxii.

The names of the Proposer and Seconder are given in brackets opposite to the names of the new Members. The addresses may be seen in the general list of Members.

PROPOSED DEC. 3RD, 1901; ELECTED AT DORCHESTER FEB. 25TH, 1902.

Thos. A. R. Littledale, Esq., 11, Greenhill, Weymouth	Captain Rickards. W. E. Pearson, Esq.
Rev. Herbert L. Wright, B.A., Church Knowle Rectory, Corfe Castle	President. Rev. J. C. Mansel-Pleydell.

PROPOSED FEB. 25TH, 1902; ELECTED AT DORCHESTER, MAY 2ND, 1902.

Lieut.-Colonel F. G. L. Mainwaring, Upwey	W. Hawkins, Esq. H. Colley March, Esq., M.D.
Haywood Sumner, Esq., Skerryvore, Bournemouth	Hon. Treasurer. H. J. Moule, Esq.
James Ralls, Esq., Bridport	W. Colfox, Esq. T. A. Colfox, Esq.
Richard Hine, Esq., Beaminster	W. Colfox, Esq. S. R. Baskett, Esq.
Miss Christine Wood-Homer, Bardolf Manor, Dorchester	President. Leonard Sturdy, Esq.
Rev. Alfred Sells, M.A., Bodorgan Manor, Bournemouth	G. E. J. Crallan, Esq., M.B. Rev. G. Thompson.

The Proceedings

OF THE

Dorset Natural History & Antiquarian Field Club

DURING THE SEASON 1901–02.

Three indoor and three outdoor meetings of the club have been held in the course of the year.

THE FIRST WINTER MEETING of the Club was held in the Reading Room of the Dorset County Museum on Tuesday, December 3rd, 1901, at 12.15. There was a large attendance.

NEW MEMBERS.—Two candidates for membership were proposed for election at the next meeting.

GENERAL BUSINESS.—The Hon. Secretary presented to the Dorset County Museum Library, on behalf of the Club, parts for 1899 of the Journal of the National Museum, Montevideo, S. America, and a pamphlet by Mr. Clement Reid, the eminent geologist, "On Seismological Investigation. Locality suitable for Observations on Earth movement." The pamphlet deals principally with the remarkable Fault at Ridgway Hill.

EXHIBITS.

BY CAPTAIN A. RICKARDS:

A large round bronze weight adorned with shields of arms. Professor Dunn, of Edinburgh, an expert in bronze objects, described it as a proof weight, being a hollow bronze ball filled with lead, which could be adjusted by adding to, or subtracting from, the lead filling.

BY DR. G. E. CRALLAN:

A water-colour drawing of the eggs, magnified about 500 times, of the following lepidoptera:—Vanessa Atalanta, Thecla W. Album, Hemerophila Abruptaria, Catocala Fraxini, Tæniocampa Munda.

By W. de C. Prideaux :

Rubbings very carefully made of the Skerne and Turbervyle brasses in Bere Regis Church, together with rubbings of both sides of a "palimpsest" brass from Yealmpton Church, South Devon, and of the Crokker brass from the same church. Plates of the Bere brasses will be found in this volume. Mr. Prideaux hopes to continue, and in time to complete, rubbings of the whole series of the ancient memorial brasses of Dorset.

By Captain J. E. Acland :

A full-sized wooden model of the cross sundial in the grounds of the Dorset County Hospital. A description of this sundial, with an illustration, will be found on page 191.

By E. Cunnington :

Fossils from the Oxford Clay and a fine blossom of the *Habrothamnus elegans*, which blooms for eight months out of the year, at Weymouth.

By Captain Elwes :

Some curiously-shaped flints, which Captain Elwes suggested might have been used as "totems."

The following papers, all of which are printed in this volume, were then read and discussed :—

1. "The History of the Roebuck (Capreolus Caprea), Palæontological and Recent," by the President.

2. "On New and Rare British Arachnida" by the Rev. O. P. Cambridge, F.R.S.

3. "The Nesting of a Pair of Missel Thrushes from the Observations of Mrs. N. M. Richardson" by the Hon. Secretary.

4. "A Puzzle about the Seeing Power of some Beasts and Birds" by H. J. Moule, Esq.

5. "Notes on the Reading of Contoured Maps" by Colonel C. J. Russell, illustrated by a contoured map of the district round Weymouth.

The meeting ended at four o'clock.

THE SECOND WINTER MEETING was held in the Reading Room of the County Museum on Tuesday, February 25th, at 12 noon.

In the absence of the President, the chair was taken, at the request of the meeting, by Dr. Vaughan Cornish, D.Sc., F.C.S., F.R.G.S., a vice-president of the Club.

NEW MEMBERS.—Mr. Thos. A. R. Littledale, of 11, Greenhill, Weymouth, and the Rev. Herbert L. Wright, of Church Knowle Rectory, Corfe Castle, were elected members; and six candidates were proposed for membership.

EXHIBITS.

BY THE CURATOR OF THE MUSEUM:

A fine specimen of the *Machrocheirus kœmpferi*, or giant crab of Japan, which has been presented to the Museum by Mr. Dare, of Yokohama. The crab has a spread of 8½ feet; some specimens measure 16 feet across.

BY CAPTAIN ACLAND:

Two ancient mechanical orreries, one dated 1794. The Rev. W. R. Waugh, commenting upon them, observed that one was a tellurian orrery; the other showed the planetary system, but did not include Uranus, which had not then been discovered, and Saturn was represented as the furthest planet.

BY THE REV. S. E. V. FILLEUL:

A pocket-flint and steel match-lighter in ivory or buckhorn, dug up on the site of the old Bell Inn in Icen Way.

BY CAPTAIN RICKARDS:

"An Indian butterfly. *Kallima Machis*, Bdv., *N. W. India*, which has a very rapid, irregular, pitching-about flight, now high over tree-tops, then low. It is fond of the shelter of large trees, near the roots of which it suddenly pitches; and, when pitched, you may hunt long to see it, however carefully you may have watched it settle, so perfectly does it resemble a dead leaf." (Capt. A. M. Lang, Entomologist's Monthly Magazine, i. 181.)

Punjaub. Occurs at Murree (7,700 feet) and Abbottabad (4,200 feet). This is probably its extreme western limit. The colouring is paler, and the specimens are rather larger than those from Burma. (Surg.-Capt. N. Manders, E.M.M., xxviii. 91.)

The divisional line on the underside of the wings, which resembles the mid-rib of a leaf, is not a peculiar feature of this butterfly, but is found in a modified form in other species, and may tend to their concealment in a less degree.

By Mr. Beckford:

An oyster dredged up in Poole Harbour with a tobacco pipe firmly attached to it.

A contoured map of Weymouth and Portland, prepared by Colonel Russell, was also exhibited. The Hon. Editor stated that the map had been accepted by the committee for reproduction in the next volume of the "Proceedings," with some notes by Colonel Russell explaining how contoured maps are to be read.

Papers were then read as follows:—

"The Eponymous Families of Dorset (Part 2)" by the Hon. Treasurer.

"An Experiment on the Movements of a Load of Brickbats deposited on the Chesil Beach" by the Hon. Secretary.

An interesting discussion followed the reading of Mr. Richardson's paper, in which Captain Elwes, Mr. Moule, Rev. H. S. Solly, Mr. Stephens, the Chairman, and others took part. Mr. Moule alluded to the opinion formerly held that the grading of the shingle was due to the gradual grinding down of the pebbles as they advanced with extreme slowness towards Bridport. Rev. H. S. Solly and Mr. Stephens mentioned the very large amount of small shingle supplied to the beach at Bridport Harbour, and allusion was made to the fact that only the small shingle is able to get round the projecting headlands to the west of Bridport, all the large being detained. Mr. Stephens hoped to be able to give some valuable data as to the supply at Bridport Harbour at a future time.

An adjournment was then made for luncheon, after which the Chairman expressed the thanks of the Club to Mr. Richardson for his paper, a paper characterised by that extreme carefulness and minuteness of detail so characteristic of its author. Although such an experiment was not intended to solve every problem connected with the Chesil Beach, yet it gave a definite answer to one or two matters which before were matters of opinion. It had been thought by many that the actions going on on the Chesil Beach were exceedingly slow, that it took hundreds of years, or even thousands, for stones to travel from one end of the beach to the other. Mr. Richardson's observations had borne out the contentions of himself (Dr. Cornish)

and others that these stones moved about very rapidly, and that the movement of the shingle upon the beach depended very much upon the direction of the wind, which determined the direction in which the breakers broke upon the shore. It was, therefore, no longer permissible to maintain as an explanation of shingle grading that all the shingle travelled in one direction, or was taken back in the other direction by an eddy. He believed that the grading of the Chesil Beach was very similar to that of a beach between artificial groynes, the big shingle being collected under the shelter of the groynes. The movement of the large shingle is mainly conditioned by the actions of the waves, while the finer shingle depends more upon the action of the current.

The opinion which Mr. Richardson had expressed, that the large stones travelled faster along the beach than the smaller ones, was also that of the late Sir John Coode [" Min. Proc. Inst. C.E.," Vol. XII., 1852-3], but he (Dr. Cornish) considered that the general grading of the beach was due to other causes.

In answer to a question, he explained the method in which raised beaches are formed by percolation. The incoming wave carries the shingle with it up the beach, but a large portion of the water percolates through the stones before it reaches its furthest point, which diminishes the depth of the retiring water to such an extent that, even with the assistance of gravitation on the downward slope of the beach, it has not power to carry back the stones brought up by it. These, therefore, remain where they have been thrown by the incoming wave, and the shingle is gradually piled up.

Dr. Vaughan Cornish then gave an interesting account of his investigations on the subject of snow waves in Canada last winter. He began by saying that up to that time the form of a snowdrift produced by an obstacle, which he had noticed in this country, had been a shelving bank on the side from which the wind came, and a comparatively steep downward slope beyond the obstacle. This, however, was due to the fact that in England

the duration of a snowfall was very limited and sufficient time was not allowed for the completion of the curve. In Canada the drift would begin in the same way, but gradually, if the snowfall continued, more snow would collect beyond the drift, until after a time the shape became a long mound with, as before, a shelving bank on the windward side and a much longer and more gently sloping bank beyond. The curve, formed by a longitudinal section of this drift, was the basis of all snowdrifts, and was a form of least eddy-making resistance. Rotating this curve on its axis (the straight line along the bottom of the section), we should obtain the ideal shape of a fish or of a fish-torpedo, which would be the shape of least resistance to motion through a liquid.

Dr. Cornish gave also other examples of this curve and illustrated his remarks by numerous diagrams drawn on a black-board. A series of these curves would be formed in a long snowdrift, and would produce a succession of ridges not unlike the ripple marks formed on sand by the action of water.

The Hon. Secretary, in thanking Dr. Cornish for his interesting lecture, said that he (Dr. Cornish) was an enthusiast in the science he had done so much to develop. He was one year to be found studying the sand waves of the desert and the next the snow waves of Canada, of which he had brought back most beautiful photographs, some of which he had exhibited to the Club at the last annual meeting.

Canon Ravenhill seconded the vote of thanks, which was passed.

The Rev. W. R. Waugh said that engineers begrudged the vast waste of the mechanical power of the sea dashing upon the Chesil Beach. It had been calculated that here was sufficient available power to light with the electric light all the towns in Dorset. It was an attractive idea, and one worth cultivating, because in the progress of civilisation it was quite possible that it might one day become *un fait accompli*.

The Rev. W. M. Barnes then read a paper "On the Form and Probable History of Saxon Church Architecture."

This was followed by a paper on "Lyme Regis Fossils" by the Rev. W. R. Waugh, in the course of which he remarked that at Lyme Regis there is "a profusion of palæontological wealth. The revelation of very many of the fossils found there is due to the frequent landslips, which occur chiefly during stormy weather, when the violent S.W. winds are prevalent and bring huge waves from the Atlantic, and after continued rains, which, percolating through the Greensand, soften the underlying Lias, in which all the fossils are embedded, cause landslips. Most of the larger fossils have been discovered after violent storms." "The Blue Lias belongs to the jurassic formation, so called from the Jura Alpine Mountains, where Lias abounds. In England it extends from the south coast, near Lyme, to the north-east coast, near Whitby, in Yorkshire, and varies in thickness in its course. At Lyme Regis it is perhaps more fully developed than elsewhere. Certainly, it is more prolific in fossils, both as to variety and perfection of specimens." Then, speaking of the intelligent work of "Miss Anning, a native of Lyme, who had devoted many years to the exhuming of the marvellous reptilians which have been found at Lyme," he stated that Miss Anning unearthed her first extinct monster in 1811. "It was an almost perfect specimen of an Ichthyosaurus, and was sold for £23. It was found in the marl a short distance from the Lyme Churchyard. Specimens of this marine reptile have been found nearly 30 feet long. It is known to be carnivorous from the contents of its stomach."

"It is recorded that Mr. Samuel Clark, of Charmouth, near Lyme, discovered the most perfect specimen of a Plesiosaurus ever found in Dorset. It was found between two of the upper beds of the lower Lias limestone. Mr. Clark sold the specimen to a Mr. Day for £40. The British Museum authorities ultimately secured it for £250."

The meeting closed at 4.30.

THE ANNUAL BUSINESS MEETING.

THE ANNUAL BUSINESS MEETING of the Club was held in the Reading Room of the County Museum on Friday, May 2nd, at 12.15. Thirty-one members attended. The President, Mr. Mansel-Pleydell, had driven in to Dorchester to attend the meeting and deliver the presidential address, but, owing to indisposition, he was not able to be present at it. In his absence, Mr. N. M. Richardson, the senior Vice-President in the room, took the chair.

NEW MEMBERS.—The following candidates for admission to the Club, who were duly proposed and seconded at the meeting on February 25th, were submitted to the ballot, and all six were elected :—Lieut.-Colonel F. G. L. Mainwaring, Indian Staff Corps, Waby House, Upwey, Dorchester; the Rev. Alfred Sells, M.A., Bodorgan Manor, Bournemouth; Mr. Hayward Sumner, Skerryvore, West Bournemouth; Mr. James Ralls, Bridport; Mr. Richard Hine, Beaminster; and Miss E. Christine Wood-Homer, Bardolf Manor, Dorchester. One new member was proposed—Mr. Wm. R. Carles, C.M.G., F.R.G.S., F.L.S., of Vine's Close, Wimborne, proposed by the Rev. J. Cross, Vicar of Sturminster Marshall, and seconded by Captain Elwes.

The HON. TREASURER then submitted a summary of the receipts and expenditure for the past year, and, in the course of his remarks upon it, he recommended that a reserve fund should be formed, a recommendation which seemed to meet with the approval of the meeting.

The HON. SECRETARY complimented Captain Elwes on the ability with which he had managed the finances of the Club. He reminded the meeting of the fact that when Captain Elwes took over the treasurership there was a deficit of £25. He had succeeded in making up that, and had a considerable balance in hand. Both the Hon. Treasurer and the Club were to be congratulated on the improvement in the finances.

REPORT OF THE CURATOR OF THE DORSET COUNTY MUSEUM ON THE ADDITIONS TO THE MUSEUM DURING THE PAST YEAR :—

It may, perhaps, be as well to begin with a passing notice of acquisitions not connected with Dorset, and then to end with a somewhat less condensed record of the department to us more important—the additions to the Dorset collections.

Several good books have been given, among which the following may be named :—From the Trustees of the British Museum, besides several other books, The Catalogue of Greek Sculpture, Vol. II., Facsimiles of Biblical MSS. in the Brit. Mus., and the magnificent Description of Ancient Marbles, 10 vols.; from the Field Club their periodical welcome gift of Nos. of the Journal of the R.S.A. of Ireland and of other kindred societies; from the Rev. W. E. H. Sotheby, Maspero's Dawn of Civilisation; from Mr. Eaton, British Rainfall in 1900 and The Meteorological Journal, Vol. XXVII.; from the Rev. O. P. Cambridge, his List of British and Rare Spiders; from Mr. J. Groves, Dupin's History of Ecclesiastical Writers, 1695; and, lastly, from the Rev. S. E. V. Filleul and Sir R. Glyn, their periodical gifts of the publications of the Palestine and Egypt Exploration Funds respectively. Of other non-Dorset acquisitions, the first mention is undoubtedly claimed for the splendid gift from Sir J. C. Robinson. It consists of antiquities from Rome. First, there is a collection of polished and mounted fragments of ancient decorative glass, almost the finest of its kind in the Kingdom. Secondly, there is a very interesting ancient marble ash sarcophagus with a remarkable inscription, and, lastly, a collection of coins, of which one at least a third brass of Delmatius, is a rarity. Mr. Eaton has most generously given a baragraph and also a fine mercury barometer, long used by the late Prof. Symons. From Mrs. Clayton, per Mr. Gibson, we have received six Roman iron arrowheads from the Station Burcovicus on Hadrian's Wall. An interesting modern antique, a pair of "dowsers," was given by Mr. Gleadowe. An old-world Japanese helmet and cuirass we received from Mr. Higgins. Miss Ashley and Madame de Satgé have given several things, *e.g.*, a wax alto-relievo of a Maltese miser. Several Nat. Hist. Specimens have reached us; a number of live Helices Pomatiæ from Mr. Old; Dr. Crallan has presented a large number of moths; Colonel Brymer, M.P., a Norwegian Lemming. Miss Cull gave four specimens of the New Zealand "vegetable caterpillar." Mr. Morgan, lastly, has sent us a specimen of the Taka-ashi-kani, the gigantic Japanese deep-sea crab.

We turn now to gifts and loans added to the collections connected with Dorset, the *raison d'être* of the County Museum.

Beginning, as in the first section, with gifts to the library, the chief one that has to be noted is a number of books, maps, etc., from Mr. Stone. Among these may be named Pastorals of Dorset, a History of Shaftesbury, and a book by the Rev. W. Barnes, new to our collection of his writings. This is an "Arithmetical and Commercial Dictionary." Another gift connected with that remarkable man is a List of his Pupils in June, 1844, from the Rev. O. P. Cambridge. We

have also to note books relating to the Blackmore Vale Hounds from Lady Theodora and Mr. Merthyr Guest. Among library gifts may be included a curious "broadside" in favour of Mr. Francis Fane, M.P. for Dorchester in 1790. It is printed on a pocket handkerchief.

Of natural history specimens there are but few to record. The Rev. W. R. Waugh presented a very fine ammonite and other fossils; Mr. Old has given a capital nest of the Bottle Tit; Mr. Beckford the shells of an oyster with its foot implanted in an old tobacco pipe; Mr. W. Cunnington several interesting pebbles from the Chesil Bank; and the President a pebble, the section of which shows signs of foraminifera. Professor Wallace has sent a very curious flint, which he pronounces to be unworked, and which is much like another which has been held to be fashioned by man. They are in Case XIII. Mr. Hogg gave three large Ichthyosaurus vertebræ. Lastly we record a gift of much interest from Mr. Pass. This consists of a set of cores from the boring near Lyme Regis. This boring, the deepest ever made in Dorset, went to 1,300ft. from the surface. It penetrated through a great part of the Kuyper Strata, the upper section of the Trias. A paper by Mr. Jukes Browne, F.G.S., has been read before the Geological Society on this subject.

On the antiquarian side the twelve months end better than till very lately seemed likely. Up to the beginning of this month very few Dorset antiquities of any kind came in. Among them it is a special pleasure to record three Roman coins given by friends, who found them in their daily work. We heartily wish that many of our neighbours would herein imitate Mr. Bushrod, Mr. Jeans, and Mr. Scriven. Our constant helper, Mr. Cunnington, has presented several worked flints, some being of palæolithic date. Another gift, which from its rudeness might be of very distant date, though this may be uncertain, came from Mr. Littledale. It is a stone mortar of noteworthy shape, being 13½in. across at its widest part and 18½in. high. Of Roman relics, we have received a small jar and horn-cores found at the Prison from Mr. Governor Hellier; a stone bead found on a barrow near Dorchester from Mr. Paterson; a horseshoe and specimens of what seem to be chalk concrete from the Rev. W. Miles Barnes, found in his excavations of the supposed Roman watercourse at or near Poundbury; and three fragments of Dorchester Roman floors lately found, from the Rev. S. E. V. Filleul, Mr. Hogg, and Mr. Osmond respectively. Dr. March has presented a Saxon sceat. The group of old keys has been enriched by three specimens from Mr. Hogg, Mr. Riggs, and Mr. Osmond. An interesting "modern antique" gift is from the Rev. S. E. V. Filleul and the Churchwardens of Dorchester All Saints'. It might have been included in the library acquisitions, but, being displayed in a double glazed frame in the Museum, it is noticed in this section. It consists of six documents, dating from a conveyance of 1460 to an apprenticeship indenture of 1715. With this group is shown an engraved portrait of the Rev. W. Benn, a 17th century rector of All Saints', whose signature is on one of the parchments, a lease of a tenement in South Street. This portrait was given by the Rev. S. E. V. Filleul, and so was the frame.

Such is the list—surely, a shorter one than it should be—of additions to the antiquarian portion of our Dorset collections from April 30th, 1901, to past the middle of March, 1902. But since this latter date two invaluable acquisitions have arrived. In the first place, the Museum Council have bought a fragment of a Roman tessellated floor found at Newberry Terrace, Weymouth. Its design is most effective, and is thought to be uncommon. The tesseræ are of five colours. The piece of floor, taken up in sections by means of glued canvas, was brought to the Museum, where it has been skilfully repaired by Mr. Tite, of Dorchester, and set up against the staircase wall. It is placed on one side of the wall space, so as to give room for other similar relics which, it is hoped, may find their way to the Museum.

Lastly, it is a delight, to announce the loan to the County Museum by Mr. Hall, of Osmington Lodge, of part of the fine collection of Dorset antiques gathered together by his grandfather. The group lent consists of sixteen specimens. There are several very good celts of polished stone and also of bronze, also a capital little bronze gouge. It is like a Winchester example in the non-Dorset Warne collection. But, until we received Mr. Hall's specimen, the Dorset collection was without one. The same may be said most emphatically of the two last objects to be noticed in this invaluable group. The first is a neck-torque found at or near Dorchester. It is like one mentioned by Sir J. Evans * in so far that this, like his, is "in two halves," and appears to have been "hinged or dowelled together." One half is perfect, though in two pieces. At each extremity it has on the widened flat end a projecting bit of bronze or dowell with a notch in it, so that it might, perhaps, serve as a hook. How it was used cannot be certainly affirmed, because one end of the other half is imperfect and the second gone altogether. But the former is fashioned into a hollow or socket, and has the appearance of having had a pin across the same. On to this pin the hook of the other half was, perhaps, hitched. The two halves are not quite alike in decoration; but this is no proof that they do not belong to one another, for Sir J. Evans describes a torque, the halves of which differ much in ornament. The imperfect half of our specimen expands at its remaining end to a diameter of $\frac{3}{4}$in., below which is a simple moulding. At about the middle of this half (when perfect) there are two surface holes. Round these and near the expanded end are faintly seen curvilinear ornaments. The perfect half at one end has a similar moulding round it, beyond which is the notched dowell. The other extremity expands to a diameter of $\frac{7}{8}$in., on the end face of which is another, but smaller, notched dowell. On one side the curved expansion has two surface holes; then comes a good sharply-worked neck of moulding. This is followed by three holes, grouping with a curvilinear triangle very slightly recessed from the surface. At about the middle of this half are two more holes with very shallow curvilinear ornament surrounding them. And, lastly, a similar ornament of graceful design is dimly seen close to the other end.

---

* Ancient Bronze Implements, p. 381.

The last thing to be noted here is probably the most valuable of any spoken of. Sir J. Evans * speaks of stone moulds for socketed celts as having been found in several Continental countries, in Scotland and, rarely, in Ireland. Of our own country, he says :—" A few stone moulds for casting socketed celts have been found in England." He specifies only two. One was in the collection of the late Rev. E. Duke, and after his death was bought by the late General Pitt-Rivers for (if memory serves) £32. The other is thus spoken of :—"The half of one, apparently for celts without loops, was found near Milton, Dorsetshire, and is now in the Dorchester Museum." Now this identical mould is part of the loan with which Mr. Hall has, the other day, so greatly enriched the Dorset, not Dorchester, Museum. There is no doubt about its being the same, for Sir John refers † to a plate of the mould of which he speaks. And this plate depicts the mould now in the Dorset Museum. ‡

These notes end with a bit of evidence which they contain. Dr. March found on the Newberry Terrace tessellated floor a Saxon sceat and, as above said, gave it to the Museum. This is witness of no weight ; but it sets one thinking of that brilliant five-coloured floor and the house, of which it was part and parcel, having been, perhaps, dwelt in by men strangely diverse from its Roman founders. Does it not partly show to the mind's eye a wild sea-rover, seax at side, long fair hair and beard waving in the sea wind eddying through the glassless windows ? There he is gloating over the loot heaped on the tessellation and planning to launch out for more in his long keel, riding close by in the Wey.

Election of Officers.—General regret was expressed at the absence of Mr. Mansel-Pleydell through illness, though the meeting did not realise the seriousness of his condition ; and Canon Ravenhill, in proposing his re-appointment to the presidential chair—a proposal which was seconded by Dr. Macdonald and carried unanimously—said they all had the greatest regard for him and fervently hoped that his health would be restored to him. The hope expressed by Canon Ravenhill, and felt by all, was not realised. To the deep sorrow of the members of the Club their revered President died early on the following morning.

The election of Secretary coming next on the list, Mr. Richardson said he was very sorry for many reasons to resign

---

* Ancient Bronze Implements, p. 432.

† The Barrow Diggers, p. 75 and Plate V., 10.

‡ From an old book of record of gifts and loans, the Hall collection seems to have been lent for a time to the Museum and afterwards returned to Mr. Hall, many years ago.

the secretaryship, which he had held for ten years; but during the last two or three years he had found that the duties were really more than he could carry out. Notwithstanding the Rev. W. Miles Barnes having relieved him of the editorship of the "Proceedings," there was still a good deal of work connected with the duties of secretary. He felt that there were several members in the Club who could well take the office, and that the time had come for him to ask one of them to relieve him of the responsibility of it. There were other reasons, which he need not go into, which also made him wish to resign the position. It was with regret he had placed his resignation in the hands of the Club, as he had had pleasant intercourse with the members during his ten years of office. He hoped to be present at the meetings as before, and should always take great interest in the Club and all its affairs.

Captain Elwes said he was sure that they all had one feeling, a feeling of intense regret at Mr. Richardson finding it necessary to resign. If any proof were needed he had only to show them some of the expressions of deep regret which he had received from many members of the Club. He had already received about 150 answers from members of the Club subscribing to the following expression of feeling:—"The undersigned members of the Dorset Field Club have heard with deep regret the intention of Mr. Nelson M. Richardson to resign the hon. secretaryship. They wish to assure him that his labours have already earned their gratitude, but beg that he will take into consideration their earnest hope that he will be persuaded to accept re-appointment for the ensuing year." If Mr. Richardson felt that he must retire it would, of course, be a very ungracious thing to press him to continue in office against his will; but they felt that his loss was irreparable, and that they would never really be able to supply his place.

Canon Ravenhill said that as one of the oldest members of the Club, he should like to say how warmly the Club had appreciated Mr. Richardson's services.

Captain Elwes suggested that the Club should emphasize the words of appreciation uttered, and put them on permanent record by passing a formal vote of thanks to Mr. Richardson; he proposed such a vote.

Mr. Pope seconded it, observing that the Club would be wanting in gratitude if they did not place on record on their minutes their appreciation of the great services which Mr. Richardson had rendered to the Club. The vote of thanks was carried.

Mr. Richardson assured the meeting that he deeply felt the kind expression uttered by so many members both now and in private letters received by him as well as by Captain Elwes. As to a successor, he considered that in a Club like theirs, with over 300 members, they ought to have no difficulty in finding an honorary secretary.

On the motion of Mr. Pope, seconded by Captain Elwes, the President, Mr. Richardson, the Rev. W. Miles Barnes, Mr. Pope, and Dr. Macdonald were appointed as a committee to report to the Club what steps should be taken to fill the post of honorary secretary, on the understanding that the new secretary would be given paid assistance if required.

On the motion of Dr. Macdonald, seconded by Dr. Crallan, Captain Elwes was unanimously re-elected Hon. Treasurer.

Captain Elwes, returning thanks, said he found the duties of the office hard, and should have been grateful if somebody had contested the election. If he consented to continue as treasurer he must stipulate that the rule of pre-payment of subscriptions should be made effective, and that all the subscriptions should be paid at the latest by the annual meeting in May, which was allowing over four months' grace. He proposed according to notice of motion given, "that the words 'one year' contained in Rule 10 be omitted."

Canon Hart-Dyke seconded, and the motion was carried unanimously.

The Rev. W. Miles Barnes was next re-appointed Honorary Editor on the motion of Mr. Richardson, seconded by Mr. Moule.

The Club adjourned for luncheon at 1.45, and the meeting was resumed an hour later.

Exhibits.

On reassembling after Luncheon, Mr. W. de C. Prideaux exhibited a second series of rubbings of monumental brasses in Dorset Churches.

The rubbings were particularly excellent, and were inspected with general admiration; process photographs of the first of a series of Dorset Brasses with descriptions will be found in this volume.

Later in the meeting Mr. Prideaux suggested that the Club should use their influence with a view to having the loose brasses at Purse Caundle refixed in the church. On his motion, seconded by Captain Elwes, the following resolution, of general application, was passed unanimously:—"That a representation be made to the custodians of brasses or those interested to have them refixed to matrices when possible, otherwise to fresh slabs, to retain these interesting ancient memorials for the county."

By N. M. Richardson, Esq.:

A fasciated narcissus. Fasciated flowers were a common monstrosity; but he did not remember having before seen the peculiarity illustrated in a narcissus.

A Double Lunar Rainbow.—Mr. Richardson contributed the following interesting note:—

On Wednesday, April 23rd, 1902, Mrs. Richardson and I, on going out of doors at eleven p.m. (at Montevideo, near Weymouth), saw a beautiful lunar rainbow. A sharp shower of rain had been falling for perhaps ten minutes, and had nearly ceased. The moon, which was full the day before (an eclipse having then taken place), was shining brightly and casting a very distinct shadow. The rainbow was in a direction somewhat west of north (the moon would be on the meridian a few minutes after midnight), and extended to an elevation of, perhaps, about 35 deg. The bow formed a complete arch, and was very bright and distinct, though not nearly so brightly coloured as a sun rainbow, the general appearance being more silvery. The colours, however, were quite visible, the violet being on the inside and the red on the outside or upper side of the bow. A second bow was traceable outside this one for about half its length, on the eastern side. It was much fainter than the primary one, and the colours, which were just distinguishable, were reversed in position. The intensity of the bows increased for a few minutes after we first saw them and then faded, and they

were quite gone by 11.10 p.m. They had doubtless been visible for a short time before we saw them, but probably not long, as we were out of doors just after the beginning of the rain storm and did not perceive them. This is the first time that I have witnessed such a phenomenon, though I have been out at night a great deal after moths. Mrs. Richardson has been more fortunate, as this is the third lunar rainbow that she has seen, but in the two former cases the primary bow only was visible.

THE PROGRAMME OF SUMMER MEETINGS.—The proposals, as usual, were submitted to the vote, with the result that Gloucester (2 days), Cranborne Chase, the Frome Valley, and Portland were selected for the outings, the dates and details being left to the discretion of the executive.

The meeting closed about 4 o'clock.

Subsequently to the meeting, Dr. Colley March, M.D., F.S.A., &c., was appointed Hon. Sec. under rule 2, and issued to the members the circular appended :—

Mr. Richardson having decided to resign the Hon. Secretaryship in spite of universal remonstrance and regret, I have acceded to the wish of a Committee appointed to secure a successor to his post.

Happily, I shall be able to profit by his experience and advice, and, in pursuance of a resolution passed at the Annual Meeting, a paid Assistant Secretary, almost necessary in the arrangement of Summer Excursions has been provided.

For one year I will endeavour to discharge the duties of the office, and, with the concurrence and support of Members generally as well as of the Committee already mentioned, to carry out the following plans :—

As regards the Summer Meetings, there will be none in June; we feel too deeply the recent loss of our beloved President; but the others will follow, as usual, with due notice given.

Hitherto the continuity of Winter Meetings has been broken by an interval for refreshments. By this interruption, not only was the attention of the assembly dissipated; its very composition was changed. Those who came in the afternoon were not altogether the same persons as those who had been present in the morning; and the sittings were somewhat protracted. It is designed, therefore, to begin the Winter Meetings at 1.15 after an early luncheon; and to conclude them, without a break, about 4 o'clock. If the number of Papers to be read, or of matters to be considered, should at any time make it desirable, more Meetings than three can be held.

It is, further, much to be wished that the subjects dealt with should be carefully and heartily discussed, and to this end the Hon. Sec. will ask to be

furnished beforehand either with the Paper itself, or with an abstract of it, that he may arrange for a sufficient debate.

There is reason to believe that many members, as well as persons who are not yet Members, are willing to be actively employed in some work to advance the objects of the Club.

It will, therefore, be attempted to form certain sections, or investigation committees, who shall choose from themselves a Reporter, and who will keep themselves in touch with the Hon. Sec. Thus, in relation to present problems, there may well be investigation committees on some of the following subjects:—(*a*) Lynchets, (*b*) Geology of Gravels, (*c*) The Ancient Water Supply of Dorchester, (*d*) A Glaciation of Dorset, (*e*) Natural History, (*f*) Archæology in its various branches, including Palæochartology.

It is, then, particularly requested of the person who receives this Circular that, if he or she is willing to do any work, he should at once write to the Hon. Sec. and say which of the above subjects interests him the most.

It may be observed, in conclusion, that should these projects succeed, my successor will doubtless continue them; whereas, should they fail, it will be easy for him to devise others, or to revert to methods already tried.

HY. COLLEY MARCH,
Portesham, Dorchester.

P.S.—Mr. H. Pouncy, of the staff of the *Dorset County Chronicle*, is appointed to be the above-named Assistant Secretary.

The appointment of President was made under the same rule. On the unanimous invitation of the Officers and Vice-Presidents of the Club, Lord Eustace Cecil consented to accept the office on the conditions stated in his letter to the executive.

CRANBORNE CHASE MEETING.

On account of the lamented death of the venerable President, the excursion to Gloucester, which was proposed for the June Outdoor Meeting of the Club, was given up. The meeting at Cranborne on Thursday, July 10th, was therefore the first outdoor meeting of the season.

Nearly 70 members and their friends assembled on that day at the Blandford Railway Station, from whence they started in brakes at 10.30 for the Museum at Farnham, where an hour was spent in inspecting the large and valuable collection of models and antiquities. The Museum contains models of the Romano-British village of Woodcuts, and of Rotherley; models of excavations made in the Romano-British Settlement at Woodyates and in Bokerly Dyke; models of the Bronze Age Camps of South Lodge and Handley Hill; models of Stone Age and Bronze Age Barrows; as well as the "finds" obtained from these places. And there are many other objects of great archæological and general interest, including a fine collection of bronzes from Benin.

King John's House.

A pleasant drive of two or three miles through delicious country scenery, and air fragrant with new-mown hay, honeysuckle, wild thyme, and gorse blossom, brought the party to King John's House at Tollard Royal, in Wiltshire, where Mr. Richardson, who acted as president for the day, called on the Rev. W. M. Barnes to give them some information concerning the house in which they were met. Mr. Barnes held that the King's "camera apud Craneburn," though it was in the forest of Cranborne, was not at Cranborne. He shewed that the King was not, at the time he was stated to have visited Cranborne, in possession of the Manor House there, which had passed out of his possession on his divorce from his wife Isabella, through whom it had come to him, and it seemed to him very probable that the King built the house at Tollard Royal at that time, so

as to have a lodge in his own Chase at Cranborne since the Cranborne Manorial House was no longer available for his residence. The date shown in the architecture of the house was consistent with this conjecture. Mr. Barnes remarked on the very perfect condition of the 13th century house, and described its original surroundings. His paper, illustrated with plans, &c., will be printed in the next volume.

King John's House at Tollard Royal now contains a series of original pictures illustrating the history of painting from the earliest times, beginning with mummy heads of the XX. and XXVI. Egyptian Dynasties and passing through Greek wall-paintings to paintings of the Middle Ages, and ending in the 19th century.

With reference to these the Hon. Sec., Dr. Colley March, observed that the point of greatest antiquarian interest in the pictures was the illustration of the transition from portrait painting on the round to portrait painting on the flat, a transition which really took place on Greek wall frescoes. He pointed to a painted round Egyptian mummy face, and then to a flat face of Ptolemaic times and to an early Greek wall painting. Such a transition as that in art was, he added, of a profound nature. During many centuries the Egyptian custom in painting the human form on a flat surface was, invariably, to show the head in profile, but with a full-face eye; and placed on a full-face bust, but with the trunk three quarters front, and the legs treated, once more, altogether in profile. A wonderful proficiency in round sculpture led to a modelling of the human face in wax, which was painted to complete its resemblance to the original. It was on this plastic substance that the great transition took place. The beautifully coloured portraits of the Greco-Egyptian period were painted on Punic wax that had been thinly poured on the linen mummy cloth itself; but in late Ptolemaic times it was spread on a wooden panel that was subsequently placed over the face of the dead.

The collection of pictures contains paintings of great value.

In the Tudor additions to the Ancient Chamber of the King were excellent and well preserved specimens of original Elizabethan furniture with some examples of Elizabethan embroidery and needlework.

Most of the party, before returning to the conveyances, entered the church close by, which contains the recumbent effigy of a knight with crossed legs, said to be of Sir William Payne. The figure is depicted clad in banded mail, a kind of armour of which no actual specimen has been handed down to us. There are only four other effigies in England representing this peculiarity of mail.

Cranborne Manor House.

Leaving Tollard Royal the party drove by way of Handley to Cranborne, passing on the way Bokerly Dyke, proved by General Pitt-Rivers to have been either late Roman or post-Roman. Viscount Cranborne had kindly given leave for the club to go over the ancient Manor House. The party entered the great hall of the picturesque old building, where a brief description of the interesting old house was given.*

The party next visited Cranborne Church, where, in the absence of the Vicar, the Rev. W. M. Barnes read the following paper :—

Cranborne Church.

This fine church, which is 141 feet long, is dedicated to St. Mary, and belonged to the Abbey or Priory of Cranborne. As this abbey existed before the Conquest, there must have been a church here in Saxon times. Of that church, except the short summary of the possessions of the abbey in Domesday, there is no record, neither is there any relic, for no part of the present structure dates from so early a period; possibly it was ruined in the troublous times which followed the Conquest, and that may account for its having been rebuilt in Norman times. The Norman Church in its turn has also disappeared, and has left no visible sign of its existence beyond the north doorway, which is of that age. Of the remainder of the Norman church nothing is left unless its stones have been built into the

* Some particulars of the Manor House will be found in Vol. VIII., p. xl., and a paper by Dr. Wake Smart on "The Ancient Connection between Cranborne and Tewkesbury" on page 29 of the same volume.

walls of this building, which is not improbable. The present church may occupy the site of the Norman church, though the plan of this church is not Norman.

The Vicar states that the church, which is Early English in style, was built in 1252. The fact that the font is of the same age as the church—Early English—suggests that the font of the old Saxon church had existed up to this time, for the Norman font, if there had been one, would, in all probability, have been in too good condition to be set aside. This font originally stood against the west face of the second pier from the tower, where there was an iron hook to hold up the cover. This was a very common position for the font in the 13th and 14th centuries. In the pier are incisions which mark the position of a small rood.

The church underwent considerable repairs and alterations in the 15th century. Presumably the old chancel which existed recently, before this new one was built, was of that age, for, according to Hutchins, in the moulding of the parapet above the east window in the centre was an angel carved supporting a shield charged with the instruments of the Passion, and on either side T. P., which were probably the initials of Thomas Parker, Abbot of Tewkesbury and Cranborne, who was elected Abbot in 1398 and died in 1421.

As the same initials occur on the oak pulpit, and as the carving of it answers to the date, it is reasonable to assume that the pulpit was set up by him. If so, it is a very remarkable relic, for wooden pulpits of that age are extremely rare.

The tower is Perpendicular in style and a few years later in date. Towards its erection the Bishop of Salisbury granted an indulgence in 1440. Probably Richard, Duke of York, father of Edward IV., and one of the Nevilles, contributed towards the building of it, as their arms are upon the two shields in the spandrils of the square hood over the very characteristic Perpendicular western entrance. The arms of the former are upon the shield on the south side.

There are some fragments of ancient glass in a window in the south aisle. Upon one of them are the arms of Clare, Earl of Gloucester.

In the unfortunate restoration of the church in 1855 the rood screen was destroyed, the pulpit removed, the ancient chancel pulled down, with the porch and its interesting chamber above, galleries taken down, and ancient benches destroyed. Some of the latter were dated 1581 and bore initials. Some excellently carved bench ends of about the same date with initials may be seen in Affpuddle Church.

Above the south arcade of the nave some interesting frescoes may be observed; they were disclosed, the Vicar informs me, two years ago; in one he says, portions of the figures of St. Christopher and Child are traceable; the next group represents the tree of life with St. Mary crowned at the top, and Eve at the bottom. In the next compartment are saints and angels adoring our Lord in glory; the date of these paintings may be 15th century or 14th; without careful examination it is difficult to fix the date. There are some ancient stones on window cills and elsewhere in the church, some of them from the foundation of a cottage; these may be remains of the ancient priory.

The registers date from the commencement of the 17th century. And of the six bells, one is very ancient with the inscription, "Ave gracia plena," in Lombardic characters.

Of the very interesting 17th century monuments in the church, I need say little, you can examine them for yourselves; the principal ones are to members of the Stillingfleet and Hooper families. They have been removed from the chancel to the west end of the church, the Stillingfleets are on the north side, and one of the Hoopers on the south side.

The famous Edward Stillingfleet, Bishop of Worcester, was born here April 17th, 1635. He entered St. John's College, Cambridge, in 1648, and was elected to a fellowship there in 1653, and consecrated Bishop of Worcester, October 3rd, 1689, and died ten years later.

Returning to the vehicles, the party set out on the drive of nine or ten miles to Wimborne, and drew up at the Crown Hotel, where tea had been prepared for them.

After tea, Mr. Richardson, addressing the members, observed that the thanks of the club were due to Lord Cranborne for allowing them to see his beautiful manor house, to Mr. Pitt-Rivers for letting them visit the Museum and King John's House, with their most interesting contents, to Mr. Barnes for his papers on the various places, and to Captain Carr S. Glyn and Mr. W. J. Fletcher, who both very kindly invited the club to tea, but unfortunately after the programmes had been issued and all arrangements made, so that it was not possible to accept either invitation. Nevertheless they offered them hearty thanks for their proffered hospitality. Last, but not least, he wished to express their thanks to their Secretary, who had given them such an interesting day and brought them back punctually to a minute, a thing which he knew from experience it was most difficult to do. He hoped that all who came to those meetings would obey their Secretary in future as well as they had done that day.

Dr. Colley March said that the President, Lord Eustace Cecil, wished him to make his excuses for not being present. He would have been with them had it been possible, and he hoped to attend their next two meetings.

The party then left the hotel and walked to the Minster, where they spent the remainder of the time at their disposal before the departure of their trains.

PORTLAND MEETING.

The second summer meeting of the Club was held in Portland on Wednesday, August 6th, under the presidency of the Right Hon. the Lord Eustace Cecil. One hundred and seven tickets were issued for the meeting, but owing to the heavy rain overnight, and the threatening appearance of the sky in the morning, the number in actual attendance fell far short of that.

The brakes left Weymouth station shortly after eleven o'clock, and the first stop was made at All Saints' Church,

Wyke Regis.

Here the party were received by the Rector (Canon S. E. Davies), who, after inviting the members to seat themselves, gave a detailed description of the church.

Of the Manor of Wyke Regis Canon Davies said :—

The earliest account we find of it is in Edward the Confessor's time, when, and no doubt long before, it belonged to the Crown. That Prince gave it, with the Isle of Portland and the Manors of Weymouth and Elwell, to the Church of Winchester by way of atonement for his severe treatment of his mother Emma. After the Conquest it is not difficult to follow its possession from hand to hand —the Earls of Gloucester and Hertford, Burghs of Ulster (Earls), Duke of Clarence, Mortimer, Earl of March, Plantagnets, Dukes of York. It was Edward IV. that brought it to the Crown, and it was afterwards granted to some of the blood royal, and made part of the jointure of several Queens of England —notably Elizabeth, Queen of Henry VII., Queen Catherine Howard, Queen Catherine Parr—and in "Lodge's Illustrations of British History" we read that the Manor of Weeke, Dorset, was one of those forming the dower of Anne, Queen of James I.

But let me go on to speak of the church. "The church," says Hutchins, "is a large structure, very ancient, and one of the best in these parts. It consists of a chancel, body, two aisles, a small aisle on the north side of the chancel, and a lofty tower of Portland stone, embattled, containing four bells, and serving by its high situation for a sea and land mark. It is the mother church of Weymouth, whose inhabitants generally bury here." This accounts for the acres of disused churchyards around us.

The church is, as you see, entirely of Perpendicular character. We have no difficulty, however, in fixing the exact date of the larger part of the church, as the following extract from the diary of Bishop Beauchamp, who was Bishop of

this Diocese from 1453, will sufficiently show. This diary or register is in the Diocesan Registry, and under the year 1455 there is an entry as follows:—"On the Sunday, the 19th day of the month of October, in the year of our Lord above mentioned, the Lord Bishop of the Diocese dedicated the parish church of Wyke Regis, situate in the Archdeaconry of Dorset, and now "de novo edificatam" in honour of All Saints, with three altars, with all the gravity and dignity due to the function, and after dinner on the same day blessed four bells hanging in the bell tower with all due solemnity."

We have a list of our rectors as far back as 1302, and are just about to print them and frame them for our porch. It is not likely that the list can be carried much further back, as our Bishops' registers only begin in 1297, though the name of a rector might occur before that as a witness to a charter. It is interesting, however, to note that Bishop Longespée, of Salisbury, who died in 1296, left 40 shillings to the "poor parishioners of Wyke."

In addition to the parts mentioned by Hutchins there is a south porch, and the small aisle on the north side of the chancel is a vestry, over which was formerly a small room. This vestry goes by the name of "Bone Chamber," owing to the fact that the old churchyard, being used for burial over and over again, many bones were unearthed, and when this took place they were always stored in this Bone Chamber. Some 70 or 80 years ago, however, a large grave was dug in the part of the churchyard opposite to the rectory, and these bones were all buried there. In the wall between this vestry and the chancel is a hagioscope commanding a view of the altar. It is a narrow slit next to the chancel, but is splayed to the width of 2ft. 9in. on the inside. The room over the vestry was originally used, perhaps, as the sleeping room of the sacristan. The window is closed up, and there is no entrance to this room. About 30 years ago or so it was opened, but nothing was found there.

The east window of the chancel has five cinquefoiled lights with tracery of a good character, but very bad glass, erected to the memory of Joseph Swaffield.

The reredos in the sanctuary is said to have been partly formed of the rood screen or parclose screen of oak, which was found stored away in the rector's old loft, but it is also stated, with more probability, to have been partly formed by the upper ornamentation portion of the sounding board which formerly existed over the pulpit. At any rate the money that was expended upon the alteration and extension of the reredos was formed by the levying a toll of £50 for the burial of Elizabeth Russell (monument) within the church in the further south-west corner. The then rector, Mr. Menzies, received the money, but died before he utilised it, and his successor, Canon Thomas, of Canterbury, carried out the improvement. The stone slab beneath the altar formerly for many years lay at the entrance gate of the churchyard at the north-east corner, and was removed to its present position about 18 years ago. It was supposed by some to be the top of the original stone altar, and the Bishop is reported to have said that some of the five crosses were decipherable, but I cannot say that I have been able to

decipher them. The Royal Arms worked in stone, now on the north wall of the chancel, were originally in Sandsfoot Castle, and were brought therefrom and placed in their present position in 1825.

The arcades of the *present* nave have five bays, formed by columns and arches of good proportions. Over each column, springing from corbels and running up between each to a string, which is continued the whole length of the church, and is ornamented with roses and square-leaved flowers, are small shafts, upon the capitals of which formerly rested the timbers of the gabled roof. The corbels, which support these shafts, have angels bearing shields, with the exception of three, which may be supposed to belong to an earlier date. Over the present roof of the nave is this inscription:—"This roof was entirely rebuilt at the charge of Mr. William Rayner, rector of this parish, A.D. 1727.—James Gaylard, *fecit.*" Over that of the south aisle, "Abraham Davis, rector and churchwardens, 1735." Over that of the north the same, 1745. All are covered with lead.

There is nothing inside to indicate the original division between nave and chancel (outside corresponding with the end of the first bay are two bases, on which, doubtless, originally stood crosses or pinnacles, marking this dividing line). The easternmost bay, however, of the arcade on each side was included in the chancel, and the rood loft occupied the whole of the second bay. The screen came at the first pillar, and the eastern parapet of the loft was carried up to a great height, the angel corbels being, as you see, cut away for it. The lower beam of the loft rested on the two large corbels in the caps of the second pillars. It will thus be seen that the presbytery originally occupied a large proportion of the church.

There were also parclose screens in the north and south arches of the chancel. You can also trace apparently the marks of a screen on the west side of the chantry in the north aisle. In the extract from Bishop Beauchamp's diary just now we heard of his consecrating three altars. Their sites are marked by the three piscinæ still in existence. You will also notice a stoup for holy water behind the south door. On the north door (with ogee arch over) is the date 1598. There are numerous mural monumental inscriptions, into which I have not time now to enter.

Several of those in the chancel are in memory of former rectors of this parish. In the chancel, north side, a small one to the members of the Buxton family, who formerly resided at Belfield, and who have vaults on the south side of the church Two especially worthy of note are those on the east wall, of the Arbuthnots and the Cornwallis Maudes, both of which speak for themselves. On the east wall of the south aisle there is one on brass, which runs as follows:—"Here lies ye body of Catherine Jerrard, obt. 22nd Sept., 1763, ætat 60. Also ye body of John Jerrard, her son, obt. 21st Nov., 1766, ætat 44. A dutiful son, tender husband, loving father, and a good friend." More of the same family are buried in the north churchyard. There is a large and handsome monument on the south wall to the memory of Samuel Weston. Others are memorials of

William Willis Weston, Swaffields, Palmers, Pennys, Davis, Wood, Heaths, Deeckers, Hardens, Paynes, Richardsons, Campbell, Awdry, and Wolfensteins. There is also a brass in the central aisle belonging to the Bayleys.

The tower is a well proportioned structure. The angles are flanked with bold double buttresses of three stages, which rise to the level of the springing of the arches of the belfry windows. The moulding of the battlements is continuous round the embrasures, and there are large and quaint gurgoyles below the parapet at the angles and in the centre of each face. This tower, which is said to have been used as a beacon tower, commands an extensive prospect. From its situation it may be seen from a long distance at sea, and it is also a familiar and conspicuous object from many parts of the neighbourhood inland. There is a peal of eight bells in the tower, which were hung anew in 1891. At that date there were three bells with inscriptions as follow:–" I. Give thanks to God. T. W. 1614." "II. John Tozier, fecit. 1723." "III. G. P. Anno Domini, 1617." These three were apparently recast into the present No. 5, which has upon it the inscription of the first, and the dates of the others. The present tenor is inscribed as follows:–" Lord may this bell for ever be a tuneful voice o'er land and sea. To call Thy people unto Thee."

The whole edifice, was restored and repewed in 1859. The floor, which when opened was said to cover a perfect honeycomb of vaults, was relaid upon a stratum of concrete two thick feet. A tablet on the outer wall of the east end of the chancel bears the following verse:—

" Here rest the village dead, and here too I,
When yonder dial points the hour, must lie.
Look round! The distant prospect is displayed.
Like life's fair landscape, marked with light and shade.
Stranger, in peace pursue thy onward road,
But ne'er forget thy long and last abode.
And, ere thy body moulder in the grave,
Repent, and trust in Christ thy soul to save."

The body of Wordsworth, great-uncle of the Bishop and brother of the poet, was buried by the Buxton vault. One part of the churchyard was filled with the bodies of those who at different times had suffered shipwreck in Dead Man's Bay and on the Chesil Beach lower down. There were two tablets to the memory of those who perished on November 18th, 1795, when the Piedmont, Catherine, and Venus (transports) and the Golden Grove, Thomas, and Æolus (merchantmen) were wrecked with almost total loss of life on the Chesil Beach.

Dr. COLLEY MARCH said he thought it would interest the Club to hear a letter written by John Wilkes, the political adversary of George III., to Michael Gerrard, the King's Purveyor. Of the Gerrards, he observed in passing, William was M.P. for Melcombe Regis in 1424, and his successors purchased

the Belfield Estate at Wyke. After the death of John Gerrard, who was drowned on his way from Portland in 1766, this estate was sold to the Buxtons, one of whom, Sir Thomas Fowel Buxton, was for 20 years M.P. for Weymouth. John Gerrard's son, Michael, was the recipient of the following letter from John Wilkes :—

"Grosvenor-square, October 1st, 1796. Sir,—I wish you now to begin to send me, as in former years, once in ten days or a fortnight, a Portland sheep, provided it be always very small and delicate. I think it will be better for you to pay the carriage and charge it to my account. Your country is remarkable for well-flavoured game. I should be glad if the hamper with the mutton might sometimes contain pheasants, or partridges, or a hare, or young wild ducks, plovers, woodcocks, snipes, &c., for my table. I would pay the best price and keep the secret—(laughter)—It might be an advantage to some of your acquaintance, as well as convenience to me. I am, sir, your most humble servant, JOHN WILKES. My daughter is fond of landrail, if you have any of that bird, as I hear there are plenty in your county."

Admiral Hardy's father was a grazier at Portesham, and the above Michael Gerrard bought of him. Dr. Colley March gave a sketch of the remarkable career of the notable politician and pamphleteer, and proceeded to give interesting particulars about the connection between St. Swithun and Portland. Domesday said that William *holds* the Island called Porland, and that Edward the Confessor held it during his life; whereas it appeared that Henry I. regranted, or confirmed a grant of, this land to the monks of St. Swithun "for food and clothing." The apparent incongruity was explained by a bequest made by Edward the Confessor (Chart No. 891 of Kemble's Codex, Anglo-Saxon), which ran "I, Edward the King, bequeath Portland and all that thereto belong to that old minster at Winchester," and which, having been attested by the perjured Harold, was ignored by the Conqueror.

As this important grant is little known, it is here given in full.

✝ Eadward kyning grétt ælle míne wytan gehádode and lǽwede; and ic cýðe eów ðæt ic hebbe bicweðen Portland and eall ðæt ðértó bilyð intó ðat ealden mynstre on Wyncheastre,

Gode tó lofe and sancte Petre and sancte Suuiðune, ðám monekan tó scrúdan and tó fódan, for mýnre sáwle and for ealre mýnre maga, and for aelre ðére kynga sáwle ðe æfter me ðyses kynyngríches waeldeð. La hwó ðisne cwidan ondón hebbe he wið Godd geméne on dómes deig. Ðyss sint ðéra manna naman ðe aett ðysan cwidan wéren, Eádgið se hléfdie, Stígand se archebisceop, Harold eorl, Rengebold cancheler.

Lord Eustace Cecil, in the name of the Club, returned thanks to Canon Davies for his interesting description of the church, and then the party returned to their vehicles and, having remounted them, continued the drive to Portland, passing on the way

Sandsfoot Castle,

now fast disappearing owing to the wasting away of the cliff, on the edge of which it was built by Henry VII. about 1539 as a defence for the coast and the entrance to the Fleet. Its walls are said to contain Norman and Early English stones brought from Bindon Abbey. Its last Governor, Humphrey Weld, of Lulworth Castle, was appointed in 1685.

At the

Chesil Beach

the party, alighting from the carriages, followed to the ridge of the Beach Mr. Hudleston, who had yielded to the invitation to address the Club upon it.* Mr. Hudleston, speaking from under the shelter of a shield of umbrellas, said it was just fifty years since he first became acquainted with the Weymouth district, and the winter of half a century ago was a most extraordinary one for gales. During many weeks westerly storms prevailed in the West Bay, and it was a magnificent sight to see the waves as they came rolling and thundering up the Beach, driven by the south-westerly wind. The water was thus banked up to a great extent in the West Bay, and one morning in January, 1853, the people had the pleasure, or the excitement, of seeing a

* A paper on the Chesil Bank by Dr. Vaughan Cornish will be found in Vol. XIX., p. 113.

vessel of considerable size which had been lifted right up upon the very top of the Beach during the night about two miles beyond Small Mouth Bay. That would give them some idea of the extraordinary power of the water in fashioning the Chesil Beach. He did not actually witness the lifting of the vessel, but he saw it there shortly afterwards. His party went up and spoke to the crew of their remarkable experience on that terrible night, for they were saved from death in a most extraordinary manner, never having expected to be saved. When the captain of the vessel found himself embayed in the West Bay, and knew that there was no chance of escape (for 99 out of every 100 vessels in such a predicament are lost), he put his ship straight for the Beach, and, there being a very high tide, the vessel, which was of considerable size, was carried right up on the top. The captain told him that the green water, 14 or 15 feet deep, drove over the Beach and fell in cascades the other side. He was rather surprised that he had never seen any notice of this sensational incident. It was well known that early last century a sloop was driven over the Beach and actually floated on the other side; but that was before he was born.

Coming to consider the question of the Beach itself, he had always been much interested in the Dorsetshire coast, and maintained that there was no part of England which contained more features of geological interest than the Dorset coast, wherever they looked at it. If they started in Swanage Bay, they found the most interesting overthrust fault, which he endeavoured to describe last year on the occasion of the Club's visit to the Isle of Purbeck. Without doubt also the magnificent scenery of Lulworth with its important geological sections presented exceptional features, and this was likewise true of the Isle of Portland itself; but a still more exceptional feature was the Chesil Beach. If they considered that the true beach began at Abbotsbury, it was about ten miles in length, and, according to Sir John Coode, about 170 yards wide and 23 feet high, and here, at Chesilton, it was about 200 yards wide and 43 feet

high. With regard to its composition, it consisted mainly of chalk-flints, and next in number were the greensand cherts, then the Portland cherts and Portland stone derived from the rocks above, and lastly a certain number of Budleigh Salterton pebbles and odds and ends from the igneous rocks of Devonshire and Cornwall. Such being the composition of the beach, they had next to consider its origin. There had been a great number of theories in regard to its origin. There were two principal ones which they had to consider. One was the remarkable grading of the pebbles, which were smaller at the far end and bigger up here. The other was the source of the pebbles themselves. The grading was a very simple matter, and had been put before them very well indeed by Dr. Vaughan Cornish.

(At this point Mr. Hudleston was obliged to discontinue his remarks owing to the rain. What he intended to say will appear as a separate paper in next year's volume, under the title of "The Chesil Beach.")

The party had finally to take refuge in the carriages. When the rain moderated they proceeded to Portland Castle, to which they were admitted by the courtesy of Colonel Childers, commanding the Royal Engineers. The castle, situated opposite Sandsfoot Castle, was built by Henry VII. Henry was apprehensive of an invasion from some Popish power, and visited the sea coasts in person, and ordered officers to examine where forts might be built in the weakest places. In 1520, on his return from France from the interview with Francis I. at the "Field of the Cloth of Gold," he put such places as were most liable to be surprised by the French in a position of defence. Thus Portland Castle came into being. It was completed in 1530. In the Parliamentary War the castle was seized by Parliament in 1642, but was soon recovered by King Charles, and was one of the last castles that held out for him. The party threaded the narrow passages and mounted the winding staircases, and noticed upon the wainscot in the little closet over the gunroom the curious inscription described by Hutchins.

A Portland Quarry.

Then leaving the Castle they drove up the hill to a typical quarry, where Mr. Wallis* explained the method of working. He pointed out each stratum from the surface to the base bed. The following were the strata in order descending:—Clayey soil and shifting rubble, 9ft. thick; top slate, 2ft. 9in.; shaly clay, 2ft.; shingle bed and soft shaly stone, 4ft. cin.; a thin seam of clay; hard slate, 4ft.; bacon tier and ash beds, 4ft. 6in.; bur and great dirt bed; top cap, 10ft.; lower dirt bed; skull cap, 3ft. 5in.; Portland roach, 4ft.; whit bed, 7ft.; and base bed, 9ft. It is the base bed and the whit bed which yield the good Portland building stone, while the roach is rougher stone, used in the construction of sea walls and such like. In working these quarries, Mr. Wallis explained, the first thing that they had to do was to look out for the joints which formed the headings and then remove the rubble. They had here an aggregate thickness of 30 feet. The great cycad was found in the shaly clay some distance from the dirt bed. The stone was all quarried by joints and wedged out, after the cap had been blasted. No blasting was done with the two beds of stone, but only in the rubbles and caps, which were thrown away. In Portland all the Purbecks were called rubble from the cap upwards. He found some time ago a splendid cycad, *cycadeoia gigantea*, and of this he showed illustrations.

The Raised Beach

at Langstone Ope would have been visited next, but the heavy rainfall had rendered the road or rather track to it almost impassable, and it was considered more judicious to give up this portion of the programme, and to drive on to Pennsylvania Castle. The upper limit of the shingle of the raised beach reaches a height of 65 feet above the sea, and it differs from any deposit that could be formed now, even in the most abnormal weather. It contains Budleigh Salterton pebbles and on the

---

* An interesting paper by Mr. Wallis on this subject will be found in Vol. XII., page 187.

east side of the Bill a few shells, but the latter are abundant on the west side, where the beach consists largely of fine sand. It was formed when Portland was part of a long escarpment extending from White Nothe across West Bay, but at a time not geologically ancient, since many of its shells are of species now living in the adjacent sea. At Pennsylvania Castle Mr. Wallis showed some pleistocene hoofs and teeth and bones of the horse that he found in this deposit.

On entering the grounds of

PENNSYLVANIA CASTLE

the Club received a hearty welcome from Mr. and Mrs. J. Merrick Head, who conducted the party through the house to the east terrace, where, amid flower-beds aglow with scarlet geraniums, stands the little cannon which, according to the story engraved upon it, was

"Presented to his Excellency JOHN PENN, M.P., Governor of Portland and Commander of the Royal Portland Legion, by his sincere and obliged friend, C. W. DOYLE, Lieut.-Colonel 87th or Prince of Wales' Irish Regiment."

Here Mr. Merrick Head addressed them, and gave an interesting historical account of the house and its contents, the ruined churches and Rufus Castle, a full description of which will be found in Vol. XII., page 21, and in the "Historical Notes on Portland" by Mr. Merrick Head in the same volume.

Mr. and Mrs. Merrick Head then led the way into the house, where a substantial tea had been prepared. After tea the meeting of the Club was held. The new President, the Lord EUSTACE CECIL, occupied the chair, and, addressing the members, said that this was the first meeting which he had been able to attend since the Club lost their late President, Mr. J. C. Mansel-Pleydell, and although throughout the county deep regret had been felt at his loss, and resolutions of condolence passed by various public bodies, yet he did not think that any expression had yet come direct from the Club as a body. It was perhaps a little late to put what they all felt into a resolution, but he hoped to be able to express the feelings of the Club on that the first

occasion on which he had had the honour of being in the chair, and desired to say how very much they felt the loss of their dearly-beloved old friend. He was as capable in his office as he was conscientious. He was beloved by all who knew him, and was much respected by everybody of whatever class and denomination throughout the county. The papers said, speaking of his scientific attainments, that he was a well-known antiquary. He hardly thought that that did justice to him. He had some knowledge of all sciences, and especially was he versed in geology, botany, and ornithology. Many of those present had no doubt read his valuable works upon flowers and birds. If they were not well known outside the county, they were "familiar in the mouth as household words" in the county. He did not know anybody who ever spoke of Mr. Mansel-Pleydell without thinking of these works, which were published years ago, and which had attained so much local celebrity. He would not say that Mr. Mansel-Pleydell's loss was irreparable, for he had lived long enough in this world to see that no loss was irreparable; but when they remembered what he was they knew that they would always sorely miss that loving and sympathetic personality, always thinking of others and never of himself, painstaking, ever putting duty before pleasure, and always ready to undertake any work in public affairs, philanthropy, or those scientific pursuits which he so much loved. He represented a type of the "fine old English gentleman," one not too common in this day. Referring to himself, Lord Eustace said he felt in rather a delicate position, because shortly after the death of the President he was asked by several members of the Club to take the office which he now perhaps unworthily held. ("No, no.") He felt that it was very hard indeed to follow in the footsteps of his dearly-beloved friend and past master, more especially in the matter of speeches upon those scientific subjects with which he was so conversant. He also felt that perhaps he was a great deal too busy, and possibly too old; but he accepted conditionally the office which he had the honour to hold, and must now look to the

members of the Club and claim their indulgence and support in his effort to carry out to the best of his powers the work which he had undertaken. The club had existed so long and earned such a reputation for itself that it would be very sad if they were to think of allowing it to fall from the popularity which it now enjoyed, or, still worse, to come to an end. His desire was that everything possible should be done to increase the well-earned popularity of the club throughout the county. And he hoped and trusted, therefore, that a large number of new members would be found to come forward and support an institution which he thought had a great future before it, both in promoting pleasurable recreation and in furthering the cause of science as far as the county was concerned. Now, continued Lord Eustace, he had to perform the pleasant duty of giving the cordial thanks of the club to all who had assisted them that day. And first to their host and hostess, Mr. and Mrs. Merrick Head. They were extremely grateful to Mr. Merrick Head for his kindness in receiving them, and for his interesting remarks in showing them all the beauties and rareties of the place and telling them their historic reminiscences. They would carry away with them a very agreeable memory of the way in which they had been treated on coming to the Island of Portland. Next they had to offer their thanks to Mr. Wallis, who kindly, under difficult circumstances—for they were not quite sure how the Clerk of the Weather was going to treat them—explained to them the formation and working of a quarry. He had also to express the thanks of the club to Canon Davies, to Colonel Childers, R.E., for granting the club access to Portland Castle, to Mr. Hudleston for his interesting speech on the Chesil Beach, which was unfortunately so rudely interrupted by the torrential rain, and to Mr. E. Cunnington, who had promised to read a paper, but was unable to do so for the same reason.

I.

FROME VALLEY MEETING.

For the last outdoor meeting of the season, which was fixed for Tuesday, September 23rd, the Club were again unfortunate in the weather. It rained persistently for the greater part of the day, yet, notwithstanding the steady drizzle, fifty-three out of the seventy-two persons who had applied for tickets, assembled for the excursion at the South-Western Station, Dorchester, at ten o'clock, and departed twenty minutes later in the carriages which had been provided for them. It spoke well for the careful organisation of the meeting that, notwithstanding the length of the programme and the unfavourable conditions, it was carried out in its entirety, with one slight exception, not stopping at Stratton Church on the homeward drive, and exemplary punctuality was observed almost throughout. The party, which included the President, the Lord Eustace Cecil, were driven first to a spot between Bradford Peverell and Muckleford, where they were received by Mr. H. B. Middleton, a valued member of the Club, who, in the interests of antiquarian research, had directed a cutting to be made, to expose an aqueduct which had been excavated in very early times, presumably to supply Durnovaria with spring water.

Here the Hon. Sec., Dr. Colley March, who has taken much interest in the discovery, addressing the members, said:—

To Major J. N. Coates, R.A., belongs the credit of a brilliant archæological induction. His theory was received with ridicule, but examination has proved its truth. A difficulty as to levels has been cleared up by excavation, especially at the spot where the road from Dorchester to Bradford Peverell dips down on leaving Poundbury. Here what appeared to be the aqueductal terrace had an adverse gradient of a good many feet. But the spade has revealed the fact that the channel does not follow this descending slope, but turns off to the east, and now lies buried beneath the existing hill, which, by the action of rains and effective winds, has been slowly travelling towards the west, covering the channel in its course. This place, called "The Eweleaze," has been chosen for section, because it presents in close neighbourhood both a lynchet and the assumed aqueductal terrace. The aqueduct has been found —at a depth of 6ft. It has evidently been cut in a previously levelled surface. The quantity of loose chalk thrown out is much greater than can be accounted for by the excavation of the channel

alone. The levelling was done by a chorobates, a rod 20ft. long, supported on equal legs, and either bearing a suspended plumb line, or, more frequently, having a channel cut in the length of the rod and filled with water. The usual fall was a-half per cent.—6in. in 100ft. This aqueduct has a width of about 6ft. and a depth of about 4ft., but one cannot expect to find any part of it after nearly 2,000 years exactly as it was when it was first made. It appears *not* to have been lined with puddled clay. The *débris* of chalk, when the carbonate of lime has been dissolved and carried away by rains or running water, is highly argillaceous, and such clay is sometimes, but not always, to be found in the channel. More often a fine rubble of chalk, agglomerated by running water and containing confervoid remains, is to be met with. Worked flints and fragments of Samian ware have also been discovered. The adjacent lynchet, which closely resembles the aqueductal terrace itself, has been cut down to the hard chalk. The hard chalk itself constitutes the lynchet. Its covering of humus is a foot thicker on the inside than on the outside of the lynchet, being 1ft. 1in. and 5in. respectively. This is exactly the reverse of what one would expect to have been produced by ploughing.

Dr. March, at Mr. Middleton's suggestion, then drew attention to specimens of the excavated material—a kind of clay, the *débris* of chalk, a chalky conglomerate which could only be made in running water. If this was examined in a glass, it would be found in many cases to contain confervæ, showing that there was water in the channel once.

Whether the channel ever went to Dorchester has not yet been proved. It had been traced to the terrace over the river by Poundbury Camp, and Major Coates, from levels roughly taken, believed that it approached Dorchester by the terrace, now a road, between the two barracks.

Remounting their vehicles, the party then drove on to

Frampton Church,

where the Vicar, the Rev. F. C. Salkeld, acting as guide, pointed out the very interesting 15th-century stone pulpit and described the subjects of the ancient carvings on its panels. A photograph of this pulpit, with an account of other noteworthy antiquities which the church contains, will be found in Volume XII. of the Transactions. The Vicar added that a good many carved stones from the original church had been built into a barn near at hand. He led the way to the vestry,

and pointed out as a specimen a small stone rood, with St. Mary and St. John standing at the foot of the cross. This is now built into the wall over the door of the vestry.

Leaving Frampton, and driving to the outskirts of Maiden Newton, the party turned into the narrow road which leads to

Frome Vauchurch,

and were soon inside the tiny church, where they were welcomed by the Rector, the Rev. A. R. South-Phillips. Of the antiquities of the church, the font was the first to come under observation, the general opinion of which seemed to be that the base was Norman, the stem modern, and the basin *might* be ancient. The church is fully described in Volume XII., and an illustration given of the quaint chancel arch, which has been widened at some time by cutting away the sides. Mr. Barnes, responding to the Rector's enquiry about the date when the Norman chancel arch was thus tampered with, said that in St. George's Church, Dunster, an Early English chancel arch was widened in a similar manner in the 15th century.

The pulpit in this church is in design and carving of unusual excellence, and of a date not later than the reign of James I.

Leaving Frome Vauchurch, after the President had expressed the thanks of the Club to Mr. South-Phillips, the party drove on to

Wynford Eagle.

"The first part of this name," the Hon. Sec. wrote in the programme, "is spelled in Domesday Book 'Wenfrot;' the second part is due to the place having belonged to the honor or barony of Aquila, in Sussex. The church is dedicated to St. Laurence the martyr, on whose day, August 10th, a wake was formerly held here." The party did not enter the church, but the Hon. Sec. pointed out where the entirely modern structure preserves on the outside of the west wall, to the north of the porch, a most interesting Norman or pre-Norman tympanum, which presents two wyverns in opposition. The letters cut in the stones of the arch, the Hon. Sec. noticed, E for example and M, are of different

THE WHITE HORSE INN, MAIDEN NEWTON,

SINCE PULLED DOWN.

[By kind permission of the Editors of "Somerset and Dorset Notes and Queries."]

types. This precious relic had fortunately been preserved from the original (possibly Saxon) Church. On the return drive the party noticed the sign of "aquila" again in the large carved stone eagle forming a finial to a gable of the picturesque old manor house, with the date 1630 carved in the wall beneath it.

Toller Fratrum.

Returning to the borders of Maiden Newton, where so many valleys with their tributary feeders of the Frome and so many village roadways all converge, the party again struck off at a tangent and drove to Toller Fratrum, once the possession of the Brethren of St. John of Jerusalem, by whom, perhaps, with mediæval humour, the neighbouring parish was called Hog or Swine-Toller—Toller Porcorum. The church is dedicated to St. Basil, and contains a very remarkable font which is illustrated with notes in Vol. XII., p. 46, some further notes with a sketch will be found in the present Volume, p. 115, where a Saxon origin is claimed for it; it certainly shows, in the decoration of the rim, ornament of debased Roman period; and in the columns represented on it, Byzantine influence which was a feature in the debased Roman architecture of the early centuries, from which the Saxon sprang.

With reference to the symbolism, represented by the figures carved upon the font, the Hon. Sec. pointed out what he thought to be the man-faced Lion of Judah succouring the human race—neckless heads indicating, not persons, but mankind.

Maiden Newton.

Maiden Newton was reached at 1.40, and the Club observed with regret that the fine old hostelry of 17th century date, which stood in the midst of the village, had been pulled down, and in its place was a modern structure of very commonplace type. The photograph facing this page shows this interesting old house, and on the left of the picture all that remains of the ancient market cross, which was erected here in the 15th century. Whilst the horses were being baited the members

inspected the church. Maiden Newton Church is an architectural enigma, which requires more time for its solution than the Club could devote to it. As in most country churches, there is a mixture of architectural styles, Norman, 14th century, and 15th century architecture being all well represented, but they are so mixed in the centre of the building that it is difficult to read there the history of the church in its stones. It is an obscure and tangled story, which only longer time and patience could unravel. So far as can be judged from the fragments that remain, the Norman church must have been an exceptionally fine one. The carving of the mask built in over the squint and upon the fragment built into the west wall of the porch is of marked excellence.

The interest of the visit was increased by the detailed remarks of Mr. John Brown, who showed the party over the church, gay with its harvest-tide decorations, and whose local knowledge was of much assistance to the Club.

The church registers date from the last year of the reign of Edward VI. The following entry is found under the year 1713:—"A catalogue of ye Rectors of Maiden Newton in ye memory of some persons now living in ye parish aforsd.:—

Dr. Whetcomb, S.T.P. (James I.). Mr. Osborn, M.A., who was unjustly turned out of his by ye Rumpish Triers, and afterwards restor'd by ye just hand of Providence. Mr. Brumhall, his base and unworthy succer., put in by yt scandalous Party, and turned out by God Almighty. Mr. Huish, A.M., who was presented by Judge Windham by ye favour of Mr. G. Strangways. Mr. Allen, Legum Bacc., presented by Mr. Th. Strangways. Mr. Cox, A.M., presented by Mr. Strangways, 1694. Mr. Charles Strangways, A.M., ye present incumbent, who was presented by ye Honble. Coll. Thomas Strangways, 1694. 1738—Mr. Alex. Malet, A.M., presented by ye Honble. Sir William Windham, Bart."

From Maiden Newton the party drove to

WRAXHALL,

where the Rev. J. Pulliblank, the rector of this parish and of Rampisham, met them and conducted them over the quaint little building, which the HON. SEC. described as containing a Norman door and chancel arch of Transition type, an Early English chancel and a north squint. Mr. PULLIBLANK exhibited an

Elizabethan chalice of unusual workmanship, and drew attention to a small memorial brass which he had found and had fixed to the chancel wall. Of

RAMPISHAM CHURCH,

the next place visited, there is little to relate, for no vestige of the ancient church remains. The Rector stated that the tower was the only part of the church which is more than 60 years old. The ancient church stood upon the same site, but the chancel had fallen into disrepair, and was replaced by the present chancel, built by Pugin in 1845 or 1846. Then it was found that the nave had fallen into very much worse repair, and the present nave was built by a Dorchester architect, named Hicks, about the year 1856. Both were guilty of the barbarism of destroying ancient work. Within the precincts of this church, which is dedicated to St. Michael, the Rector pointed out a notable churchyard cross of Ham Hill stone of 15th century date. The shaft has nearly all gone, but its base is adorned with episodic sculptures, which are described in Hutchins. Attached to the cross is a platform, or a table tomb, also of Ham Hill stone, with an inscription showing that it was erected as a memorial. The Rector stated that only the word "Porter" could now be deciphered, and it is an interesting fact that there is a parcel of ground in the neighbourhood called "Porter's Mead." The date of the death of this "Porter" given in the inscription and repeated on the cross is MDXVI. The inscription had a stop ornament between each word in the style of the inscriptions on bells of the same date. Hutchins gives the inscription in full:—

"+ Fili + Dei + miserere + mei + et + sic + dicit + Porter + in + nomine + Jhu + amen + obiit A.D. MDXVI."

From the church the party proceeded, by kind leave of Mrs. Martin, to the Manor House to inspect the building and an old oak overmantel. The house appears originally to have been in style debased Perpendicular, windows of that period being still left in the ancient part of the house. The remainder of the house

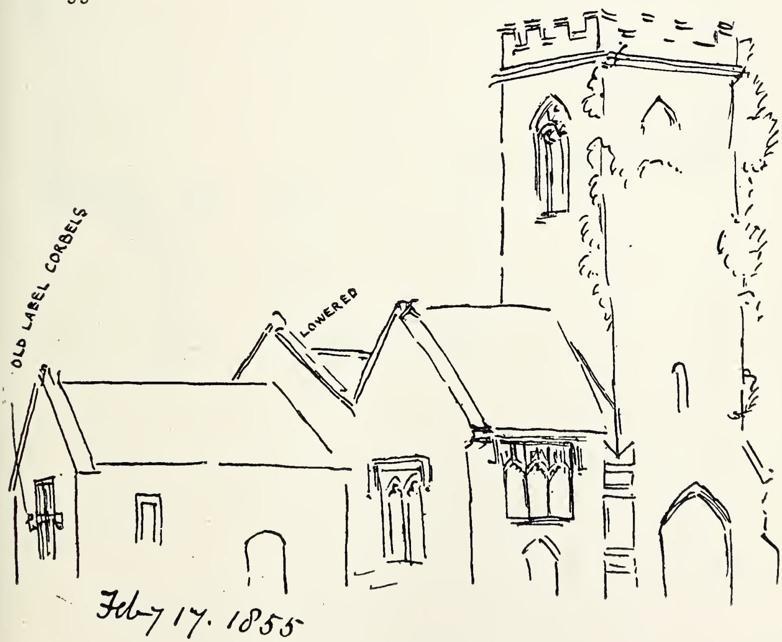
seems to have been built in 1605, when some of the ancient windows in the old part were replaced by windows of the later date.

The date cut upon the platform or tomb is 1606, the date on the addition to the ancient manor house is 1608. Was there any connection between the two? Was the Porter commemorated on the former the proprietor or occupier of the manor house, and did his successor put up the platform as a memorial to him and then enlarge the house? The platform may have been added to the cross, or the cross re-erected upon the platform, the platform to serve either as a stand for a preacher or as a protection to the cross. The iconoclastic zeal of Puritan reformers might spare a cross adopted as a memorial to the dead, though it would not spare a rood in or out of a church under any other circumstances. At least, this cross escaped injury for a long time; it seems to have been perfect when Hutchins wrote his history. To the archæologist the collection of mediæval flooring tiles and coins laid out in the hall for inspection were of considerable interest; they were all found within a few yards of the east wall of the manor house when draining and levelling the ground to form a croquet lawn. At

CATTISTOCK

on the homeward journey the party stopped at the Church of SS. Peter and Paul to make a short visit of inspection, but chiefly to hear the fine carillon of Belgian bells (35 in number). By the direction of the Rector (the Rev. R. P. Stickland), who received the party at the church, the bells were set playing. Inside the church the Rector pointed out a few objects of archæological interest, namely—(1) Large slab of Purbeck marble, with an incised cross upon it, built into the wall in the south aisle. "It was discovered (1857) lying on its face, some inches below the soil, in the Chantmarle aisle. It is very ancient, and probably was the upper part or lid of a stone coffin which contained the body of one of the early rectors or founders of the church." (Rev. Henry Still's letter to parishioners.) (2) Hagioscope (discovered under plaster of wall of old church, 1857).

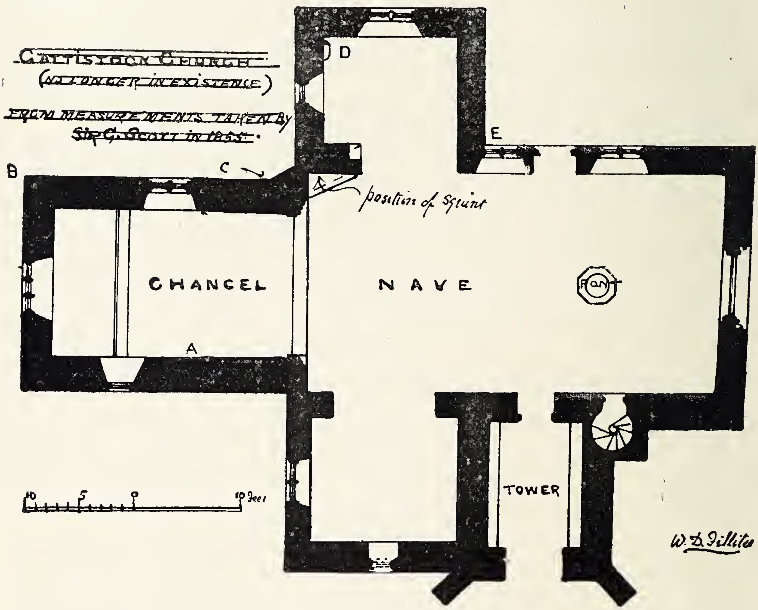
Its position was slightly altered (in 1857) to enable people in the south aisle to look through it to the chancel. In 1860 it was covered by the new organ. (3) Ancient slabs—found in the Early English wall of chancel of the old church—are fixed in east-end wall of south aisle (1857). (4) Upper portion of ancient cross fixed in a recess on the north side of the sanctuary. (5) Tracings of Sir Gilbert Scott's rough plan and sketches of the old church (1857). The south, or Chantmarle, aisle is Early English; the north aisle was built by the Rev. John Mayo, 1630; the rest of the building is modern. When the square chancel was pulled down in 1856 the foundations of an older apsidal chancel were discovered, and upon this the present chancel was built. The only existing representation of old Cattistock church is to be found in the tracings of the rough sketches made by Sir Gilbert Scott in 1855.



CATTISTOCK OLD CHURCH.

From a Rough Sketch by Sir Gilbert Scott.

As the church is fast passing out of memory, and these sketches are in a very frail condition, it has been thought advisable to reproduce, on a reduced scale, one of them, which would give a general idea of its appearance. Mr. W. D. Filliter has kindly drawn the plan of it from measurements left by Sir Gilbert Scott, and parts of this plan have been lettered to show where certain interesting old relics of earlier periods were found built into the walls of the old church which were pulled down.



PLAN OF CATTISTOCK OLD CHURCH.

A. In this wall was found the ancient fragment built into the recess in the nave over the tombstone; this was probably the oldest fragment found. This wall was Early English.

B. The lowest quoin of this angle, when taken down, was the old stoup, now replaced in the porch.

C. The chancel was rebuilt to this point.

D. Slab removed to east end of the new aisle.

E. One of the quoin stones in this angle was the Saxon slab now in the recession vestry.

(The above notes are in the handwriting of Jas. Thos. Irvine, who was clerk of the works at the time of the rebuilding. The walls of the new chancel appear to have been put back 9 inches or a foot on each side.)

A stop was to have been made at Stratton, but as time was pressing the party had to drive on to Wrackleford House, where they were cordially welcomed by Mr. and Mrs. Alfred Pope and hospitably entertained to tea. After tea the business meeting was held, over which the Lord Eustace Cecil presided. The noble President offered the thanks of the Club to their many kind friends, the incumbents of the parishes and others, who had contributed to the pleasure of the day, and he was sure they all would join him in thanking Mr. Pope for the warm welcome he had given the party on that occasion, and for the way in which he invariably supported the Club at all times; and congratulated the hon. secretary on the admirable way in which the expedition into the Frome Valley had been carried out. The Hon. Secretary then read out the names of the fourteen candidates proposed for membership, and the party shortly afterwards drove back to Dorchester, and to the railway stations there.

Dorset Natural History and Antiquarian Field Club.

Dr. *RECEIPTS and EXPENDITURE from April 26th, 1901, to April 26th, 1902.* Cr.

	£	s.	d.		£	s.	d.
Balance, April 26th, 1901	146	12	5	Sime and Co., for Programmes, Circulars, Posting, Printing and Binding Vol. XXI.	146	0	0
Subscriptions, Entrance Fees, and Arrears ..	209	17	6	Blakiston, "National Trust, &c."	1	1	0
Donations to Plate Fund	0	16	0	Meisenbach	11	19	0
" H. S. Eaton, Esq.	9	0	0	Hon. Editor's Expenses	1	4	3
By Sale of 8 Vols. of Proceedings	4	4	9	On Deposit, Wilts and Dorset Bank	160	0	0
				On Current Account do. do.	50	6	5
	£370	10	8		£370	10	8

Dr. *GENERAL STATEMENT, April 26th, 1902.* Cr.

	£	s.	d.		£	s.	d.
Payments due from							
65 Members for 1901	32	10	0	Balance in favour of the Club from Payments due for the Past Year and for the Current Year ..	90	10	0
116 Members for 1902	58	0	0				
	£90	10	0		£90	10	0

G. R. ELWES,
Hon. Treasurer.

Dorset Natural History and Antiquarian Field Club.

HON. SECRETARY'S ACCOUNT from May 1st, 1901, to the date of Appointment of a New Secretary (Dr. March) in June, 1902.

Dr. RECEIPTS.	£ s. d.	Cr. EXPENDITURE.	£ s. d.
Balance from last Account	1 10 0	H. Voss for Three Meetings on Dec. 3rd, 1901, and Feb. 25th and May 2nd, 1902	0 15 0
By Balance on Incidental Expenses at Meetings at Cerne, Exeter, Purbeck, and Salisbury	6 5 5	Hon. Secretary, Postages, &c.	4 6 10
		Balance handed to Dr. March	2 13 7
	£7 15 5		£7 15 5

NELSON M. RICHARDSON.

The above-named Balance, £2 13s. 7d., has been received by me.—H. Colley March.

In Memoriam

THE LATE JOHN CLAVELL MANSEL-PLEYDELL, ESQ.,

OF WHATCOMBE,

B.A., J.P., AND D.L., F.G.S., F.L.S.,

President of the Dorset Natural History and Antiquarian Field Club.

By the Hon. MORTON G. STUART-GRAY.

The Dorset Natural History and Antiquarian Field Club has suffered a well nigh irretrievable loss this year in the death of the dearly-loved President, Mr. Mansel-Pleydell, which occurred at his family seat at Whatcombe on May 3rd at the age of 84. Mr. Mansel-Pleydell, in conjunction with Professor Buckman and the Rev. H. H. Wood, founded the Club in 1875, and during the long period of 27 years he was annually re-elected its President. He took unceasing interest in its well-being and spent a vast amount of time in the furtherance of its objects, contributing innumerable papers to its publications, and by his constant attendance at the Field Meetings he added immensely to its efficiency and popularity. Although at his own request he was relieved from time to time by the common consent of the members from some of the more onerous duties, which he considered inseparable from the presidential office, his labours subsequently were none the less arduous, nor were his contributions perceptibly diminished.

Among the many and varied interests and duties of his pre-eminently useful life the Dorset Field Club occupied a very

leading place. To write a memoir of Mr. Mansel-Pleydell, which is at all adequate to the subject and to the pages of this XXIII. Volume of "Proceedings," is a task of considerable difficulty. This task I should have hesitated to undertake if I had not been urged to do so in a letter which I received from the Rev. J. C. Mansel-Pleydell, Vicar of Sturminster Newton, which conveyed the wishes of his family on this subject, and, as I believe, of various members of the Field Club. And since I have been connected with the Club from its foundation, and held the post of Secretary for some years, together with the fact of my being closely related to the late President, I felt that this was a last act of loving duty, which could not be refused.

Notices touching on one or other aspect of Mr. Mansel-Pleydell's life have already appeared, *e.g.*, in the "Times," in the "Journal of Botany" for July by the Rev. E. F. Linton, in the "Dorset County Chronicle" by Mr. Henry Moule and Mr. R. Bosworth-Smith. In these pages it is impossible to give an account of a life of such varied interests. As the owner of a large landed property, Mr. Mansel-Pleydell fulfilled to the uttermost the duties connected with it as Magistrate, County Councillor, and Poor Law Guardian. As a student of the natural sciences, he possessed a wide and detailed knowledge of various branches, though it is on his works on botany and geology that his fame chiefly rests. As a philanthropist, his foundation in 1856 of the Reformatory for Boys at Milborne, which in later years developed into the Industrial School and Boys' Farm Home of the present day, showed him to be in advance of his times. His advice and assistance in the management of the Dorset Friendly Society in years gone by earned him the deep gratitude of its members. He was a steadfast supporter and a devoted adherent of the Church of England. During the later years of his life he took great interest in the formation of the Wilts and Dorset Branch of the Clerical and Lay Union, and undertook an infinite amount of work and correspondence in the capacity of its President.

With this brief survey of his career I propose to confine myself as far as possible to those chapters of Mr. Mansel-Pleydell's life which describe his connection with the Dorset Field Club and his investigations in the subjects which fall within the scope of its enquiries.

Societies for the study of natural history and archæology have long been in existence in various counties. In Dorsetshire, however, this had not been the case, although no county is better suited for these researches. In Geology it possesses an almost unbroken series of Mesozoic Beds, and of the older Tertiaries; its Flora is rich and varied, and its Avifauna highly interesting. Throughout its length and breadth the remains of the Prehistoric period and of the Roman occupation are numerous and important. In the limited area of Purbeck, it is true, the Purbeck Society had had a brilliant existence. The first meeting of this body was held at Durnford House, Langton Matravers, on April 5th, 1855, and, although after the first ten years the meetings ceased, the collections formed by the society were still retained in the building at Corfe, which was rented for the purpose, until 1894, when they were transferred to the County Museum at Dorchester. The publications of this society were entitled "Papers read before the Purbeck Society," Vol. I. and Vol. II., Part 1. Mr. Mansel-Pleydell was Vice-President in 1858. He contributed papers to the society on "The Blashenwell Chalk Marl," on "Kimmeridge Coal Money," and on "Tertiary Fossil Leaves." In the year 1874 a movement was made towards the formation of a Dorsetshire society for research in natural history and archæology. This originated largely with Professor Buckman, then resident at Bradford Abbas. He had been elected to the post of Professor of Natural History at the opening of the Royal Agricultural College, Cirencester, and, in addition to his collegiate duties, had devoted much time to the discovery and preservation of Roman remains, in which that district of Gloucestershire is so rich. Professor Buckman's proposals, in the first instance, were made to the Rev. H. H. Wood, Rector of Holwell, who, having

been successively Fellow, Tutor, and Librarian of Queen's College, Oxford, had taken the College living of Holwell in 1857. He, moreover, was a botanist and geologist. The Dorset Field Club owes its origin to the initiative of these two men. The general plan gained in definition as it gained numerically in supporters, and towards the end of 1874 it seemed likely to take shape, if only a suitable leader could be found.

Mr. Mansel-Pleydell was born in 1817, and was educated at Hazelbury Bryan under the Rev. Henry Walter, a former Professor of Natural Philosophy at Cambridge. He entered at St. John's College, Cambridge, where he took his B.A. degree in 1839, and subsequently read for the Bar. His parents resided at Smedmore, near Corfe, until 1863, when, on the death of his mother, it passed into his own possession. Here in the parish of Kimmeridge he made one of his greatest discoveries by unearthing from a low cliff facing the sea the paddle of *Pliosaurus macromerus*, which is now preserved in the County Museum, Dorchester. Casts of this paddle are included in the collection of the British Museum, the Woodwardian Museum at Cambridge, and elsewhere. Here, too, on the margin of the sea coast he was able to prosecute operations in dredging which were to bear fruit later on in his accounts of the Mollusca of Dorset. By the year 1874 he had already published his first edition of the "Flora of Dorset," which included many species added to the county by his own industry and observation, preceded by a sketch of its geology. He had written a sketch of the geology and flora of the county, together with prefaces to the ornithology and conchology for the 3rd Edition of Hutchins's History of Dorset, published by the late William Shipp, of Blandford. He had written a similar account of the geology of Dorset for the "Geological Magazine" of 1874, which I remember was strongly commended to my notice by my tutor at Cambridge. The Rev. E. F. Linton mentions in his account of Mr. Mansel-Pleydell in the "Journal of Botany" for July, 1902, that "his first contribution to this journal appeared in 1866, when (as J. C. Mansel) he gave an account of *Leucojum*

vernum in Dorset, and his last, on *Arum Italicum* as a Dorset plant, appeared in 1900, and between these dates he published many notes. During his visits to London he was frequently at the Natural History Museum and a welcome visitor to the Department of Botany, with whose officials (present and past) he was on terms of friendship." For years Mr. Mansel-Pleydell had taken daily observations on rainfall and meteorological phenomena. In 1874 he was in possession of the Whatcombe property, residing at Longthorns, midway between Dorchester and Blandford. As a landowner who had lived in the county from childhood, who was so thoroughly acquainted with its every aspect—one, moreover, who had done so much in scientific study and research—Mr. Mansel-Pleydell was clearly the man to be approached with a view to inducing him to take the lead in the new society. This was done, and, with the enthusiasm which characterised everything he undertook, he threw himself heart and soul into the formation of the Dorset Field Club.

On Tuesday, March 16th, 1875, a meeting was held at the Digby Hotel, Sherborne, at which about twenty persons sat down to dinner, after which a paper was read on the "Aims and Objects of Natural History Field Clubs," followed by "Notes on the Working of some Established Field Clubs." At this meeting, I believe, the foundation of the Field Club took place, Mr. Mansel-Pleydell being elected President, Professor Buckman Secretary, and the Rev. H. H. Wood Treasurer. Four meetings were arranged for the ensuing summer months. The first annual meeting was held at Sherborne on May 30th, 1876, when Mr. Mansel-Pleydell delivered his presidential address, in which, after sketching the meetings of the Field Club during the past twelve months, he described the additions made to the flora of the county during the year, the progress of the Wealden boring, questions of interest arising from published returns of rainfall by Mr. G. J. Symonds, the Challenger Expedition and its possible results, the Arctic Expedition under Captain Nares, which had then lately left England, and Lieut. Cameron's journey through Central Africa—subjects all of which were engrossing

the scientific attention of the country at that time. The first volume of the "Proceedings" was published in 1877, and contained as its frontispiece a photograph of the President in the uniform of a Captain of the Q.O.D. Yeomanry Cavalry, in the Melbury Troop of which he served for about thirty years.

Interest in these early days chiefly centred in the Field Meetings, and very pleasant they were. The authorised programme was usually very simple, but the unauthorised programme might extend to any length; members dropped off when they chose, the President being always one of the last to leave. A meeting was held at Dorchester in the autumn, 1875. During the day we reached Maiden Castle. The Rev. W. Barnes, "The Dorset Poet," was present—a figure well known in those days in the dress he always wore. He was quite ready when occasion required it to open out on any subject connected with archæology, which he approached from the etymological side through his knowledge of Anglo-Saxon and Early English. I remember during the afternoon picking up a flint with a sponge, *Ventriculites*, embedded in it, and showing it to the President. He immediately called the attention of the party to it and delivered an extempore address on its features. Later we dropped in by twos and threes to the King's Arms to a repast, and the meeting was carried on afterwards. By and bye we found ourselves such a small circle that the carriage was ordered, and he and I drove back to Longthorns, which we reached at 10.15, but I was to have gone six miles further to Blandford. "No, no! you must stop here. How could you have expected to get back the same night after a Field Club meeting?"

He was at his best, or nearly so, when presiding at the head of the table during the hour of repast, and would thoroughly enter into the spirit of any pleasant surprise. On one occasion, at Stalbridge in the autumn of 1876, if I remember right, some sections of the Cornbrash had been examined during the early part of the day, and, as the afternoon grew dark, the party was conducted to the village inn, where Professor Buckman gave a discourse on edible and poisonous fungi, after which tea or

supper was served. During its progress the Professor had arranged to give the practical illustration to his previous remarks, for he had carefully provided that four dishes of as many species of fungi should be cooked and brought in towards the end, and was greatly disappointed to find that his eloquence had been wasted, for scarcely any one would venture to taste them. The President was greatly pleased at this method of turning even the refreshment of the Club to a scientific end, and laughed heartily over it ; but I cannot remember that he felt himself sufficiently convinced to take the first helping.

Criticism on his speeches or addresses he welcomed, but at Field Meetings it is not often forthcoming. On one occasion which I remember it appealed strongly to his sense of humour, and he was delighted. It was at a meeting held at Swanage in September, 1876. After some preliminaries, the party converged on Peveril Point, where the President delivered an unwritten address on the geological character of the Isle of Purbeck, as far as it was visible towards the east and north-east, referring to the great upheaval of the chalk and its extremely faulted condition, which is clearly visible in many places from the decks of the passing steamboats. Then, turning round, he described the succession of the Purbeck Beds lying to the west and south-west, and entered into a detailed account of the strata, particularly of the insect and cinder beds. On sitting down, a Swanage visitor, who happened to be a distinguished geologist, asked if he might be allowed to make some remarks, which was at once granted. He spoke to the following effect (I am quoting from memory at an interval of 27 years):—"I am a stranger to Dorset. I arrived here only a day or two ago, attracted by the reports I have heard of the county—of Purbeck in particular—and of the inhabitants, who were described to me as models of simplicity, cleanliness, and other domestic virtues. I caught sight of your party just now and came to pick up anything I could by way of information. I have listened to you, sir, who, I am told, are intimately acquainted with the county you are describing, and I gather that all that part of Purbeck I

can see in front of me is faulty to a degree, whilst for the rest of it, if I take the trouble to examine—the beds even—I shall find they are full of insects." The speaker then passed on to an elaborate discussion of various questions touched on by the President. Many a time for months afterwards, when we were together, a smile would cross his face, and, on inquiring the reason, he would answer: "I was thinking of that facetious fellow—that day at Swanage—and his remarks about the insects in the beds."

In 1882 the Rev. H. H. Wood, who had held the post of Treasurer since the inauguration of the Club, died. The Rev. O. P. Cambridge was elected Treasurer in his place. Two volumes written by him on "The Spiders of Dorset" were published by the Club in 1882. Another loss was experienced not long afterwards by the death of the Secretary, Professor Buckman, in the autumn of 1884. About this time there was a matter of large interest both to the President and to the welfare of the Field Club itself, which took place in 1883. I refer to the removal of the collections of the old Dorset Museum into the well-built and commodious premises which they at present occupy, which was largely due to the generosity of the late Mr. R. Williams, of Bridehead. Mr. Mansel-Pleydell had always been a supporter of the County Museum, but, on entering its new home, he evinced the greatest interest in its success. His constant wish was that its collections should be as representative as he could make them of all that was best in the County of Dorset, and with this object he spared neither time nor pains to obtain specimens or collections by purchase or otherwise which were in danger of going out of the county, subscribing himself most liberally to that end. Amongst the gifts which he made from time to time to the Museum were the *Pliosaurus* paddle previously mentioned; the tusks and molars of *Elephas meridionalis* found by him at Dewlish, until then unknown to Britain, except on the Norfolk coast; a footprint of *Iguanodon* from the Middle Purbecks, in which it is rare, though not so in the Wealden. To him also the Dorset Museum is indebted for

what is believed to be the best specimen in the kingdom of *Histionotus angularis*, Mid Purbecks. Several good specimens of Dorset birds were presented by him, including the honey buzzard. Amongst the antiquarian collections many objects were gifts from him; for instance, a funeral urn from the noted Deverel Barrow on the Whatcombe property opened many years ago; the results of his excavations in the Roman well at Winterborne Kingston; and those from the site of the Roman pottery works at Bagber. Finally, he left to the Museum his large and valuable herbarium.

From 1883 the County Museum became the home of the Dorset Field Club. Here the annual meeting has always been held in the month of May, and, by an addition to the original annual programme, at first one and subsequently two meetings have been held during the winter months within its walls, through the generous co-operation of the Secretary and Trustees. To the programmes of these indoor meetings the President contributed numberless papers and addresses, many of which were elaborate and of considerable length, and unsuited in character for the Field Meetings. For these the quiet atmosphere of the Museum building on a winter morning was eminently fitted. They are far too numerous to even mention, but will be found broadcast in the volumes from VII.-XXII. of the "Proceedings" of the Club. In 1888 the President published "The Birds of Dorsetshire: A Contribution to the Natural History of the County." This was followed in 1895 by the publication of the second edition of his "Flora of Dorset," a far more important volume than the first, and in 1898 appeared "The Mollusca of Dorset." A copy of each of these books was presented by the generosity of the author to all the members of the Field Club.

These papers and addresses, but particularly the presidential addresses at the annual meetings, were models of their kind, involving great labour and research. His constant aim in these, after reference to general matters, was to give, as far as possible, a synopsis of the whole field of scientific investigation during the past twelve months, after which he would take up some

particular subject as the topic of the address. From reading over these addresses, which will be found in the "Proceedings," it will be seen that this was his rule. Such was the plan of the last address he delivered in 1901. It is pathetic to think that it was during the drive from Whatcombe to Dorchester, on the 2nd of May, for the purpose of attending the annual meeting of the Club, where he was to deliver the address, which is printed in this volume, he was seized with the first symptoms of the attack, which ended fatally in the early hours of the succeeding morning.

No one will be more sincerely mourned, and no place will be more difficult to fill than that of Mr. Mansel-Pleydell. Of what the loss is to the immediate circle of his family I cannot here speak.

For myself, it is the loss of a very dearly-loved friend, and, when I think of the many, many happy days spent together in his favourite pursuits, dating back to a summer vacation at Cambridge, it seems to me a loss that can never be replaced. I can remember with a vividness as of yesterday days spent along the sandbanks at the mouth of Poole Harbour, around the margins of the brackish lagoon of Littlesea, amongst the Punfield Beds of Punfield Cove near Swanage, or the Purbecks above the cliffs of Tilly Whim and Dancing Ledge, or the Kimmeridge Clay around the shores of the bay, from which it takes its name. Other days there were nearer home, when the shooting van was brought out from its summer repose, and we started in it directly after breakfast for Morden Decoy, for Bere Heath, and the water meadows around Chamberlain's Mill; or, perhaps, our course was turned towards the Vale of Blackmoor to hunt for plants along the outcrop of the beds beneath the chalk. On these occasions he was quite untiring, walking fast the whole day; no rest was given for luncheon—it was eaten as we went; his mind was on the alert for everything he saw around him; and his conversation inspiring and sparkling with numberless anecdotes, chiefly of Dorset character and recollections. Yet, underlying all, and never absent, was the spiritual nature of the man, which manifested itself as freely and as naturally in his converse as the

subject on which he was at the time engaged. So, too, over an object which had attracted his attention, and in which on further examination he recognised some more than usual beauty of structure or design, one would frequently hear an exclamation uttered with the deepest devotion, even as of thanksgiving from an over-full heart, "How wonderful are Thy works, O God!"

In writing this memoir, I have been under great obligation to Mr. Moule, the Curator of the Dorset Museum, for many particulars which are embodied in the foregoing paragraphs. He, from his official position, was in close intercourse for nearly 20 years with Mr. Mansel-Pleydell. With his permission I quote the following lines from his letter, for I think nothing could express the sense of the loss to his department so well:—

"His hearty interest and sympathy in all my work there (the Museum) were of priceless value to me. And I need not say that his knowledge of natural science, as regards both its extent and accuracy, and also his willingness – nay, rather, friendly eagerness to impart it to me in answer to many, many requests for advice, was simply invaluable; and then in money help he was generosity itself. I can hear him now with his cheery 'I'm good for a fiver' in answer to, not a request, but often to the merest passing word about some work looming in the distance as needful. As to the Field Club, I have said a word about his papers, but his personal presence at Field Meetings was ever a delight to me. To get near enough on these occasions to hear him give an impromptu object lesson was a delight to me that I shall never forget. Two among many such occasions I specially remember. Once when I literally 'sat at his feet' and heard him at Lulworth Cove talk about the strata facing us; the other time was in the Gardens at Abbotsbury. Then he walked from sub-tropical plant to plant – *Aralia* to *Eucalyptus*, bamboo to camellia - and told us about them in a way that was a perfect joy to me."

I have endeavoured to sketch some personal recollections, and yet I can but feel how very incomplete they are. To realise this fully, one must have known the man. As Mr. Bosworth Smith has so well said, "He was greater and better in himself than in anything he either said or did;" and, in concluding this memoir of Mr. Mansel-Pleydell, I will borrow a description of him from the same writer, which seems to me to sum up his character with epigrammatic conciseness, as that of "a saint who already saw Heaven opened."

Anniversary Address of the President.

HAPPILY, the death roll of our Club in the past year is small. I have to record the loss of four only by death—my relative, Sir Edward Medlycott, Mr. Frederick Fane, Major Sparks, and Mr. B. Willcox.

Mr. Fane was related to the Fanes of Apethorpe, his grandfather being brother to the 11th Earl of Westmoreland. His presence was always welcome at the meetings of the Club, and contributed an appreciable quota of those elements which have made the meetings so popular.

The hearty reception of the Club by Mr. and Mrs. Fane at Moyles Court in June, 1893, will be in the remembrance of most of the members. On that occasion Mr. Fane read after luncheon a very interesting paper upon the ill-fated Alice Leslie, once the possessor of Moyles Court, who was sentenced to death by Judge Jeffries at the "Bloody Assizes" and beheaded at Winchester for giving shelter and concealment to Hicks, a dissenting minister, after the Battle of Sedgmoor. His paper, entitled "Legends of Milton," was a useful contribution to the lore of the village gossip. Mr. Fane's third paper gives an interesting account of Ellingham Church, which was built about

the year 1230, and in which Alice Leslie lies buried. Major Sparks read an exhaustive paper to the members on Langton Herring in 1892.

I shall now continue my examination of Reptiles, which I was unable to finish last year on account of its length.

The extinct Dinosaurs were discovered relatively late. In 1824 Buckland made known the first remains of this order under the generic name of *Megalosaurus*. In the following year Mantell discovered the remains of *Iguanodon and Hylosaurus* in the Weald of Sussex. In 1841 Owen proposed to comprise the genera then known, under a distinct order, which he named DINOSAURIA. Further discoveries continued to increase the number. In a series of very important memoirs on the classification and genealogy of the order in 1868 and 1869, Huxley selected *Compsognathus* as a uniting link between this extinct group of reptiles and the earlier group of birds. Ten years later Marsh commenced to publish the results of his examination of Dinosaur-remains which had been discovered in large numbers, and often in a perfect state of preservation, in the Western States of N. America. Besides the discovery of several skeletons of *Iguanodon* at Bernissart (Belgium), Hulke, Seeley, Lydekker, and Baur have made valuable contributions to the knowledge of these extinct reptiles.

THE DINOSAURIA began and ended in the Mesozoic Age, and had a world-wide distribution. From a teleological point of view, they are of some importance. Many attained to enormous proportions, surpassing every other recent or extinct animal; only a few of them did not exceed the length of three feet. The balance of life was kept up, as it is now, by carnivors and herbivors. The greater size of the posterior limbs, in proportion to the rest of the body, is one of their distinguishing features; they were principally used for progression. The fore limbs, being feeble and short, like the living kangaroo, were used, perhaps, for bringing arboreal food to the mouths. Their strong hind limbs enabled them to raise their massive bodies in an erect position, or to keep them high above the

ground when at rest. They differ from the reptilian type by the connection of the ribs with the vertebral column and by two occipital condyles, instead of one; also by the consolidation of at least four anchylosed vertebræ for the sacrum, instead of the usual reptilian two, which gave additional strength to the pelvic-arch. The flat surfaces of the vertebræ and the hollow bones of the limbs are also differentiated features. The teeth of the herbivorous Dinosaurs have a special adaptation for grinding their food, wholly dissimilar to any other living reptile, except the Iguana of tropical America. Previous to the important discoveries by Cope, Marsh, and others, in the Upper Jurassic and the Upper Cretaceous deposits of N. America; our knowledge of the order obtained from the European deposits had left many gaps unfilled. Professor Marsh has brought to light features of some importance in connection with Dinosaurs, especially the construction of the skull, the vertebral column, and the pelvic-bones, to which Hulke, Seeley, and Lydekker have added much to our knowledge of their structure.

The Dinosaurs are classified under the sub-orders ORNITHOPODA (which include *Trachydontidæ*, *Iguanodontidæ*, *Scelidosauridæ*, *Stegosauridæ*, *and Ceratopidæ*), THEROPODA, and SAUROPODA. THEROPODA holds an intermediate position between the ORNITHOPODA and SAUROPODA, and includes *Anchisauridæ*, *Megalosauridæ*, *Compsognathidæ*, *and Celuridæ*. SAUROPODA embraced *Atlantosauridæ*, *Diplodocidæ*, and *Cetiosauridæ*. Nothing is known of the European SAUROPODA except isolated bones and vertebræ of *Cetiosaurus* and *Streptospondylus*, which approach the CROCODILIA, and to which Order Owen at one time attached them. The Crocodilian *Parasuchia*, a carnivora, approaches the herbivorous SAUROPODA, whose fore and hind limbs are furnished with five toes each, differing little in length; like the CROCODILIA they have no clavicles. SAUROPODA occur in the Upper and Middle Jurassic Beds of England and the North of France, and of N. America (Wyoming, Colorado), and in the Wealden and the Middle and Lower Cretaceous Beds of England.

Lydekker, in his Catalogue of Fossil Reptiles in the British Museum, 1888, adopts Marsh's views of the SAUROPODA and the THEROPODA, but he joins the *Stegosauridæ* with the ORNITHOPODA. The *Cetiosauridæ* of the sub-order SAUROPODA are typically represented by the English genus *Cetiosaurus*, which appears to be so nearly related to the American *Morosaurus*. Mr. Lydekker considers that both may be united, from the well ossified limb-bones, the free projection of the head of the femur into the acetabulum, and the large terminal claws. He also concludes that *Cetiosaurus* was of terrestrial or sub-aquatic habits, and that it dwelt among ferns, cycads, and conifers on the banks of rivers or the borders of lakes. This has been remarkably confirmed by the discovery of its allied American forms, and has now become a matter of history. *Cetiosaurus* occurs in Great Britain in the Lower Jurassic, Great Oolite, and the Forest-Marble Beds of Oxfordshire and Northamptonshire.

ATLANTOSAURIDÆ.—This family is represented by *Atlantosaurus*, *Apatosaurus*, and *Brontosaurus*, from the Upper Jurassic Beds of N. America, and by European types to which they appear to have a more or less close alliance. The study of all European *Sauropoda* is beset, as Mr. Lydekker says, with almost insurmountable difficulties, in consequence of the isolation of the bones one from the other, scarcely one of them being found in close approximation.

Brontosaurus, Marsh.—*Brontosaurus excelsus*, Marsh, from the Upper Jurassic of North America. Its total length as estimated by Professor Marsh was upwards of 50 feet and its weight about 20 tons. The head was remarkably small, neck long like Ornithopsis, the centrum of each vertebra composed of highly cellular bony tissue, having a large cavity on each side; the tail massive and the bones solid. The head is smaller in proportion to the body than in any vertebrate hitherto known. The entire skull is less in diameter, or in actual weight than the fourth and fifth vertebræ. The small head and brain and slender neural cord indicate a stupid and slow-moving animal. It had no offensive or defensive weapons nor any dermal armature.

Its habits were more or less amphibious; it fed probably upon aquatic plants.

Ornithopsis, Seeley.—*Ornithopsis Hulkei*, Seeley, from the Wealden of the Isle of Wight, and *O. Leedsi* are reptiles considerably smaller in dimensions than *Brontosaurus*. The ischium has the downward direction characteristic of the Atlantosauridæ, and is comparatively wide in proportion to the pubis. *Pelorosaurus* from the Kimmeridge Clay, Weymouth, originally described as *Cetiosaurus humerocristatus*, Hulke, and another species *Ischyrosaurus Manseli*, Hulke, from the same formation at Kimmeridge Bay, may be probably referred to *Ornithopsis Leedsi*.

THEROPODA.—Carnivorous, with prehensile claws; very small fore-limbs, hollow limb-bones, vertebræ of sponge-like structure, premaxillary teeth, and united pubes; no post-pubis as with the Ornithopoda. They were gigantic creatures, varying from the size of an Elephant to that of a Cat, and they resembled quadrupeds in the structure of their feet rather than Birds; hence their name. They walked on their hind-legs and used the fore-legs for holding and grasping. They appear to have lived on the sea-coast. Their remains extend from the Upper Lias to the Upper Cretaceous Beds. The teeth are laterally compressed, and curved backward, with sharp edges, of which the posterior (and sometimes the anterior) borders are serrated, the serrations being generally at right angles to the axis of the crown. The tail is of great length and power, and served as a support to the body. The skeleton of the THEROPODA was extremely light. The large bones are hollow, and filled with air like those of the *Cœluridæ* and *Compsognathidæ*; the vertebræ are hollow, with a very thin osseous wall. The skull is incompletely ossified, and has a large inter-orbital vacuity. The pubes project downwards, and are united at their distal ends. The ischia are united, and evidently served as a "foot" when the animal reposed. The number of digits of the fore-feet vary from four to five; while that of the hind-feet is from three to five. The terminal phalangeals have curved claws, which in the fore-limb are very long and prehensile, well adapted for seizing and holding prey.

This sub-order has its maximum extension in the Trias of Europe, N. America, the East Indies, and South Africa, and in the Jurassic Beds of Europe and N. America. One family alone, the *Megalosauridæ*, persisted so long as to reach the Upper Cretaceous Age.

Megalosaurus, Buckland.—The reconstruction and classification of this extinct animal from only fragmentary remains brought great triumph to Buckland and Phillips. The genus ranges from the Lias of Lyme to the Cretaceous Beds of Maestricht, in Holland. It has also been reported from similar beds in Southern India. There is evidence of two species from the British Wealden. The femur of this gigantic representative of the order THEROPODA was 3ft. long. The manus had five toes and the pes four. Mr. E. Clemenshaw obtained a skull from the Inferior Oolite, near Sherborne; which, if I recollect rightly, is deposited in the Museum of Sherborne Grammar School. Sir Richard Owen read a paper upon it to the members of the Geological Society of London, which is published in Vol. XXXIX., p. 234-237. *Allosaurus fragilis* from the Jurassic Beds of North America appears to be allied to it.

Brontozoum.—A genus of gigantic animals, known only by their foot prints in the Triassic formation of the Connecticut Valley, U.S. The stride was about 8 feet, and the length of the foot print about 17 inches. Each foot had three toes. There are marks of seven such prints upon a slab 30 feet long in the Appleton Museum, Amherst, Massachusetts, U.S. The right and left feet moved alternately. Its long trailing tail left an impression on the sands and muds over which it passed.

CERATOSAURIDÆ.—*Ceratosaurus*, the only genus of this Family, is represented by one species, *C. nascomis.* It comes from the Upper Jurassic Beds of Colorado, North America. The head is large in proportion to the size of the body, long, elevated, and rounded in front, furnished with a horn-core on the nasal bones, below which and in front is the nasal opening. The orbits are oval and oblique, with an antiorbital opening, triangular in shape. These openings or fossæ reduce very much the weight of the

skull. The teeth are strong and pointed with two cutting edges; vertebræ, flat in front, deeply concave behind *(opisthocœlian)*; sacrum with five anchylosed vertebræ; caudal vertebræ amphicœlian. All the presacral and anterior caudal vertebræ are concave; fore limbs very short. The pelvis differs from that of the rest of the Dinosaurs, except the Cretaceous Ornithomimus, in three of its elements, the ischium, ilium, and pubis being anchylosed. There are other differences, apparently peculiar to this genus, which are not met with in any other Dinosaur; but, this being the only known specimen, they may be attributable to pathological causes. At the distal end of the skull there is a series of dermal osseous plates for the protection of the neck.

COMPSOGNATHIDÆ.—Very small Dinosaurs, known only at present from the Upper Jurassic Beds of Europe, typified by the genus *Compsognathus longipes*. The whole skeleton is extremely light and pneumatic. The skull long, resembling that of a bird, but furnished with strong teeth. Contrary to Huxley's opinion, Marsh proves that *Compsognathus* in all its essential characters resembles the carnivorous Theropoda.

According to Huxley *Compsognathus* progressed in an erect or semi-erect position. Its long neck, slight head, and small anterior limbs must have given it a strong resemblance to a bird. The hind limbs had four toes, of which three only were functional, the fourth had two phalanges and did not reach to the ground. The teeth approach the Megalosaurian type. Its total length did not exceed two feet. Remains have been found entire in the Solenhofen Lithographic Stone, Bavaria, Upper Oolite. One specimen of *C. longipes* seems to exhibit an embryo in the abdomen. A small reptilian skeleton has been recovered from the Jurassic Beds of Colorado, which is thought to represent a Theropodous Dinosaur, and capable of leaping. It is named *Hallopus victor*. In the hind limb the femur is shorter than the tibia, the metatarsals are much elongated, and there are only three functional digits. *Anchisaurus colurus*, Marsh, is another Triassic Dinosaur, small in size, and is known by nearly complete skeletons. The skull is remarkably bird-like, the orbit

large, and the teeth nearly uniform. The hind limb is one-third larger than the fore limb, which has five digits, the first three only bearing claws, while the fourth and fifth are rudimentary. The hind foot has four functional digits. This Dinosaur occurs in the Triassic Sandstone of Connecticut, United States.

Sub-order Ornithopoda.—These are herbivorous Dinosaurs of very varied proportions, ranging throughout Jurassic and Cretaceous strata. Some must have been bipedal in gait, others quadrupedal; but all agree in the characters of the pelvis and in the presence of a predentary bone in front of the mandible. The astragalus does not exhibit an ascending process. The unarmoured Ornithopoda are represented by the *Iguanodon*, and the four-toed *Hypsilophodon* in the European Wealden; by *Camptosaurus* and *Laosaurus* in the Jurassic; and by *Hadrosaurus* and *Claosaurus* in the Cretaceous Beds of North America. The armoured Ornithopoda, or Stegosauridæ, as they are often termed, range from the Lower Lias to the Upper Cretaceous Beds in England, and from the Jurassic to the Cretaceous Beds in North America. *Scelidosaurus*, from the Lower Lias of Dorset, is only partially armoured. *Stegosaurus*, from the United States, and *Omosaurus*, from the Oxford and Kimmeridge Clays of England, are provided with great spines and dermal plates; *Polacanthus*, from the English Wealden, has the lumber-sacral region completely encased in a continuous shield of fused plates. The limb-bones of the unarmoured Ornithopoda are hollow, while those of Scelidosauridæ and Stegosauridæ are solid. We are indebted to Owen, Huxley, Hulke, and Dollo for much of our present knowledge of the European forms of Dinosaurs; to Marsh and Cope for that of the American forms.

Stegosauridæ.—*Stegosaurus ungulatus*. The head is remarkably small, and the brain seems to have been smaller in proportion to the size of the animal than in any other land-vertebrate. The teeth are very numerous, arranged loosely in sockets. The neural-spines are expanded for the support of the dermal armour. The cervical vertebræ bear short ribs; the dorsal show especially elevated neural arches, on which the stout ribs are borne. The

sacrum comprises four anchylosed vertebræ, sometimes with one or more lumbar vertebræ in front. The fore-limb is very powerful, though small. The pelvis is extremely massive for the support both of the armour and the large hind-limbs of the animal. The femur is large and straight; there appear to have been three functional digits to the hind-foot, No. 1 being rudimentary, while No. 5 is entirely wanting. There seems to have been a median crest, composed of very large triangular plates, along the back; there are indications also of a shield of small rounded ossicles under the mandible, and on the throat. The genus was originally described by Marsh from the Upper Jurassic of North America; but certain forms from the Oxford and Kimmeridge Clay of England, under the name of *Omosaurus*, cannot be separated generically from *Stegosaurus*. The typical species, *S. ungulatus*, probably attained the length of thirty feet.

SCELIDOSAURIDÆ.—*Scelidosaurus*, Owen. This genus is known by one nearly complete skeleton and many scattered fragments. The head is small. The end of the snout is unknown; the teeth are those of an herbivorous animal. All the vertebræ are amphicœlous, some of the centra having an internal cavity. There are six or seven cervical vertebræ, and sixteen dorsal; the femur, tibia, and fibula are hollow. For Dinosaurs the Scelidosauridæ are of moderate size. The almost complete skeleton of *S. Harrisoni*, from the Lower Lias of Lyme Regis, is about four metres in length. The armour seems to have consisted of massive bony cuneiform plates in a double longitudinal row upon the neck and back; on each side of the body the ventral part was similarly armed. Some progressed only on their hind limbs, others were quadrupedal, but all agree in the character of the pelvis and the presence of a predentary bone in front of the mandible. The pubis is rod-like and slender, directed downwards and forwards; at its base there is a slender post-pubis directed backwards and downwards, and parallel with the ischium. This pelvic structure approximates to that of the Ratite bird.

TRACHYDONTIDÆ (Hadrosauridæ) resembles the *Iguanidæ* in form and structure, but differs in some respects, especially in dentition. The teeth are arranged in a number of vertical columns, articulating together so as to form a kind of pavement. The type-genus was first described from the Upper Cretaceous Beds of the United States, but was subsequently found in the Upper Greensand of Cambridgeshire. The cervical and dorsal vertebræ are opisthocœlian. The fore limbs very short, the hind limbs long, and the femur furnished with a trochanter, which rises crest-like.

IGUANODONTIDÆ, *Iguanodon*.—This is one of the first discovered Dinosaurs, named from the resemblance of its teeth to those of the modern Iguana. The predentary bone is crescent-shaped, with a jagged margin, which seems to have been covered by a horny beak. The teeth are fixed in separate incomplete sockets. The successionals are ready for use when required below the functional row. The vertebral column consists of about 80 vertebræ, of which 10 are cervical, 18 dorsal lumbar, from 4 to 6 sacral, and the rest caudal. With the exception of the atlas the cervicals bear ribs. Of the pectoral elements the scapula is remarkably long and slender. The humerus is slightly curved, having a prominent radial crest; but the radius and ulna are very robust. The long and almost vertical symphysised ischia, which nearly touched the ground, suggests that they supported the animal when in a posture of repose. The hind limbs and the long tail, which, judging from the high chevrons and the long neural spines of the caudal vertebræ, were probably furnished with strong muscles, were attached to the fourth trochanter of the femur, to act as a balance when the animal was in an erect position. The tibia and fibula are approximately of equal length; the hind foot is tridactyle; the fore limbs shorter than the hind limbs, but equally strong; the paws adapted for grasping, possibly for defence or offence; the pollex, although short, is furnished with a formidable weapon, or spur, fixed at right angles to the other four digits, the second and third of which were protected by hoof-like nails. The skeletons

of *I. Bernissartensis*, Dollo, were found in an extensive depression at Bernissart, near Mons., in a Wealden deposit about a thousand feet below sea level, in which no less than 30 specimens were associated. Five of them are mounted and exhibited in the galleries of the Royal Museum at Brussels. Isolated bones of this species and of *I. Mantelli* had been previously met with in England. *I. Dawsoni*, an intermediate between *I. Bernissartensis* and *I. Mantelli*, is characterised by the centra of the vertebræ being less compressed, and by the shape of the ilium, which has a deep, rounded post-acetebular process. *Iguanodon* is distinct from *Camptosaurus*, with which it was at one time confounded. They can be distinguished from each other by the number of the sacral vertebræ, and by the shape of the femur and the ilium. Three species of *Iguanodon* occur in the Wadhurst Clay, Lower Wealden, of Sussex—*I. Dawsoni*, *I. Fittoni*, and *I. Hollingtoniensis* —which connect the typical *Iguanodon* with *Camptosaurus*. *I. Hollingtoniensis* has a curved femur and a pendent third trochanter, alike with *Camptosaurus*. The vertebræ of the sacrum are separate and not anchylosed, as with *Iguanodon*.

Camptosaurus.—This genus is usually smaller than the preceding. It occurs in the Upper Jurassic Beds of N. America, and in the Oxford and Kimmeridge Clay of England. The curved femur is longer and stouter than the tibia, the trochanter being pendent, or directed downwards. It has five digits in the fore-foot; the first does not reach to the ground. The Upper Jurassic Beds of Wyoming and Colorado contribute *C. dispar* and *C. amplus*. Lydekker assigns to this genus *Iguanodon Prestwichii*, Hulke, from the Kimmeridge Clay, Cumnor, Oxfordshire; *I. Leedsi*, Lydekker, from the Oxford Clay, Northamptonshire; and *I. Valdensis*, Lydekker, from the Wealden.

Hypsilophodon, Hulke.—This is by far the smallest species of the Iguanodon family; and for the classification of it we are indebted to the late Mr. Hulke, F.R.S. It was found in the Wealden at Cowleaze, Brixton, Isle of Wight, by Mr. Fox. The frontal bones of this Dinosaur are nearly as long as the nasals. It is about four feet in length, and has four

powerful, large digits, and a small rudimentary fifth. Its very small fore-feet had four digits also, and a fifth rudimentary digit. The sharp-pointed and curved ungual phalanges suggest that its habits were arboreal. The sides of the crowns of the teeth were like those of the Iguanodon. It had no dermal armour.

Cliosaurus.—One of the most recent of the Dinosaurs. The skull is similar to that of the Iguanodon; edentulous premaxillæ, and enormous nasal openings. There are thirty presacral vertebræ, nine sacral, anchylosed together, and about sixty caudal, the first and second of which do not bear chevron-bones; the vertebræ behind them are very long. The fore-limbs are extremely small compared with the hind-limbs; both are solid. The ilium is much elongated; the pre-acetabular is much more slender than the post-acetabular. The fore-paw is elongated; there are only three functional digits, with elongated metacarpals, and three phalanges to each. The functional digits are hoofed. The femur is long and straight, with the fourth trochanter in middle of the shaft. The first and fifth digits are entirely wanting in the hind-foot; the three others are massive, with broad hoofs. The typical species is *Cliosaurus annectens*, known by two nearly complete skeletons from the Laramie Beds (uppermost Cretaceous) of Wyoming, U.S.A. It is about nine metres in length.

Towards the close of the Mesozoic Age, when the huge Dinosaurs were gradually becoming extinct, a remarkable group of horned animals appeared, supposed to be a specialised branch of the armoured Stegosauridæ. The type genus *Ceratops* is found in the Upper Cretaceous (Laramie Beds), Wyoming, Colorado, United States. This and *Triceratops* are named in allusion to the great horn-cores, one pair of which is placed above the eyes; they resemble those of the Bovidæ, and were probably sheathed with horns. A third genus, *Sterrholophus*, has the nasal horn-core short and blunt, not sharp and pointed as in *Ceratops*; the parietal crest covered with ligaments and muscles supporting the head, whereas in *Ceratops* and *Tricerotops* a wide margin of the face was exposed, and protected

by a thick horny covering. This Dinosaur also is found in the Upper Cretaceous Beds of Wyoming and the Upper Cretaceous Beds of Austria. It was covered with dermal scales. *Triceratops* comprised five species—*T. prorsus*, *T. flabellatus*, *T. horridus*, *T. serratus*, and *T. sulcatus*. The skeleton of this genus indicates an animal of robust proportions and quadrupedal in gait. All the bones are solid. The skulls of the largest specimens exceed in size that of any land animal hitherto discovered, and are only surpassed by some of the modern Cetacea. There is a strong cutting beak in front, a strong horn on the nose, a pair of very large pointed horns at the top of the head, and a row of sharp projections round the margin of a posterior crest, which protected the nuchal and jugal regions. The upper toothless beak is formed by the premaxillæ, and an additional median "rostral" bone in front. The brain cavity is exceedingly small. The two-fanged teeth are arranged in a single functional series; the crown is adapted for herbivorous diet. The atlas and axis are fused with one or more of the succeeding cervical vertebræ to support the massive head, which is said to be six feet in length. The dorsal vertebræ have remarkably short centra. The two lumbars are anchylosed with the sacrum. There are five hoofed digits in the fore-foot. The ilium is much elongated, and its anterior extension forms a horizontally-expanded plate; the pubis is massive, with only a very slight trace of a post-pubis; the ischium is smaller and more elongated, and does not meet with its fellow on the opposite side. The femur is short compared with the size of the animal. Apparently there were three hoofed digits in the hind-foot. The dermal-armour comprises numerous bony tubercles and bosses.

Ceratops, Marsh.—This genus comprises three known species —*C. horridus*, *C. montanus*, and *C. paucidens*—from the Upper Cretaceous Beds, Montana, Dokota, Colorado, Wyoming, North America. The skull carries a pair of large horncores. The body is covered with dermal scutes, which had probably overlying horny shields like those of Chelonians. Similar horn-like bones occur in the Upper Greensand of Austria.

Struthiosaurus.—(*Cratœomus*, Seeley, who distinguishes two species—*C. Pawlowieschi* and *C. lepidophorus.*) It is somewhat identified with *Acanthopholis* and *Scelidosaurus*. It has a frontal horn-core similar to that of an Ox, about 20 centimetres long, associated with portions of a dermal cuirass composed of polygonal, conical, pointed, bony plates; the lower jaw shows a single row of alveoles and an outer one with shallow vascular pits, the crowns of the teeth pointed and triangular, with sharp cutting edges. The vertebræ are short and massive, nearly flat on both faces; their greatest number is in the caudal region.

Nodosaurus, Marsh, from the Laramie Beds, is a form more or less allied to *Stegosaurus*, characterised by the completeness of the dermal armour, which consists of rows of rounded knobs, becoming small and quadrangular near the head.

Stenopelix, H. Meyer, from the Wealden of Bückeburg. It differs from all other members of the sub-Order ORNITHOPODA by the presence of cavities in the centre of the caudal vertebræ; the hind-foot has four digits and long metatarsals; claws straight and sharp; dermal covering unknown.

In summing up the physiology of the Dinosaurs we note that many possess hollow instead of solid bones. In the SAUROPODA the vertebræ have large cavities, notably in *Brontosaurus*. In many THEROPODA (the carnivorous section)—*Coelurus*, *Anchisaurus*, *Compsognathus*—the limb-bones and the vertebræ are hollow, the latter being reduced to thin-walled shells, with a few inner partitions, like the septa of the Nautilus, to give strength to the shell. In the ORNITHOPODA the vertebræ are solid, but the limb-bones are hollow. This hollowing is an economy of material and weight, and at the same time, without loss of strength, the surfaces for the attachment of the necessarily powerful muscles are increased. Most probably these cavities were, as in birds, filled with air-sacs, in communication with the lungs. Their mode of propagation can only be guessed at from the circumstance that a rather well-preserved specimen of *Compsognathus* contains in its abdomen what may possibly be an embryo. There is nothing against the assumption that the

Dinosaurs were viviparous; on the contrary it seems more natural than that, for instance, an *Atlantosaurus* of more than 100 feet in length and many tons in weight should have laid eggs. Some of the herbivorous Dinosaurs, namely, the *Stegosauri* and the *Ceratops*, had a dermal armour of variable extent. The plates were loosely imbedded in the skin, and reached their greatest size along the middle of the back and tail. These crested plates were obviously weapons of defence. The *Ceratops* was armed with a pair of huge pointed horns on the head and a smaller one on the nose. These were probably used as weapons to resist the attacks of equally large carnivorous Dinosaurs.

Although there are some characteristics amongst the Dinosaurs which also occur in birds, they are mere coincidences. There is an enormous difference between the limb of the oldest known bird, *Archæopteryx*, and the fore-limb of any Dinosaur, however bird-like in the hind-limbs. Their fore-limbs are modified in a direction diametrically opposed to that from which a bird-like wing could be developed.

AVES.

The account of the few remains of fossil birds which were known at the beginning of the last century was published by Cuvier. In 1863 Milne-Edwards contributed a general review of the geological distribution of the fossil birds, and published a voluminous monograph, 1867 to 1872, on the fossil birds of France. In the year 1860 a fossil feather was discovered in Lithographic Sandstone of Solenhofen, and a year later a whole skeleton of this primitive bird was found at Eichstatte, and was described as a winged Reptile. In 1863 Owen recognised in it the characters of a true bird, notwithstanding the long tail and the peculiarly constructed fore-limbs. Many palæontologists considered it to be intermediate between a Bird and Reptile. In 1875 Marsh drew attention to the occurrence of toothed birds in the Cretaceous Beds of Kansas, N. America. The fossil extinct birds of New Zealand were described in detail by Owen in various Monographs (1849—1889). In the Transactions of the

Zoological Society, Vol. xi., 1883, there is a description by this distinguished palæontologist of the head and feet, with the dried integument of *Diornis didinus*, a fossil Moa from New Zealand, by which the characteristics of the genus might be studied in a living specimen. The fragments consisted of the head and continuous part of the neck, and trachea covered with the skin, also of the bones of both legs, with the feet and claws, and some feathers. The bone-ring of the sclerotic was exposed, and with it some of the ossicles. From the structure of the foot, especially the length and curvature of the phalanges to which the claw is attached, Owen inferred that the hind-limbs of this Moa were made use of for the work of uprooting the ferns, which, from the nutritious matter the roots contain, supply at the present day a favourite food of the Maoris. In 1866 (sixteen years previously) Owen described and figured the bones of the Dodo. In 1871 he read an exhaustive paper "On the Articulated Skeleton of the Dodo" (*Didus ineptus*, Linn.). In the Transactions of the Philosophical Society for 1879 there is a paper "On the Osteology of the Solitaire" (*Pezophaps solitaria*, Gmelin), by Professor A. Newton and his brother, Sir E. Newton, published in 1869, and another by Sir Edward Newton and Mr. J. W. Clark in 1874 on this extinct bird of Rodriguez. The Dodo inhabited Mauritius, down to the latter part of the 17th century. The Solitaire was found only in the island of Rodriguez, where it survived about a century later. These large birds were formerly very abundant, and, being favourable for eating and easily captured, they were soon greatly diminished in numbers, and at length became entirely exterminated.

The remains of birds are rare in Europe and America, and, from the wandering habits of this class, they are of insignificant value as indications of past changes in physical geography. A large proportion of the remains belong to aquatic or wading types. There are some interesting cases of extinct land-birds belonging to groups now quite strangers to the country in which they are found; others again of groups now peculiar to certain

areas which have been preceded by allied species or genera of gigantic size.

In the caves and other Post-Pliocene deposits of the Palæarctic Region and North India the remains of birds are found, of which almost all belong to genera now inhabiting the same regions. The only exceptions, perhaps, are the Great Auk and the Capercailzie, found in the Danish refuse-heaps; the *Tetrao albus*, in the Italian bone-caves; and a Pheasant (*Phasianus*), said to have been found in the Post-Pliocene of France, considerably west of the existing range of this genus, in a wild state. Only one Pliocene species (*Gallus bravardi*) of the Gallinaceous group has been found. It is allied to the Domestic Fowl and the Peacock. The Miocene beds of France and of Central Europe have produced remains of birds allied to existing genera, but with notable exceptions. Aquatic and wading birds were abundant, including Rails, Bustards, Heron, Sandpipers, Gulls, Divers, and Pelicans.

The Miocene Beds of N. India have furnished very few specimens. The birds of this period differ very little from those now living, with the addition of a few tropical forms. In the Eocene Beds we find ourselves almost entirely among extinct forms. The earliest known is a Passerine, *Protornis*.

The latest contribution to Fossil Birds is by Mr. Lydekker, F.R.S., "The Catalogue of Fossil Birds in the British Museum," an octavo volume, pp. 368, which deals with 169 genera and 389 species.

The exo-skeleton of the Birds consists almost entirely of horny sheaths, scales, plates, or feathers. None have dermal ossifications, except spurs, which are developed upon the legs and wings of some species, and may be regarded as such. Each feather is composed of the calamus or quill, and the vane, which extends to the distal end of the shaft, and bears a number of hooked barbs, arranged laterally. These barbs are narrow plates, tapering to points at their free ends, and attached at their base to each side of the rachis; the interstices of the barbs are filled each with a hooked barbule, which interlock with

those of the barbs. Muscles connect the adjacent integument with the feather-sac, and by contraction can erect the feathers at the will of the bird. Some feathers have the barbs free, and are soft and downy. In some birds, the Turkey for instance, the skin of the head and neck develope vascular processes, with erectile powers, such as combs and wattles. The spinal column of Birds consists of several vertebræ, six of which are more or less anchylosed together, and form a solid sacrum. The cervical vertebræ are never less than eight nor more than twenty-three in number. In the RATITÆ the cervical vertebræ have short transverse processes, similar to those of the Crocodilia. The sternum or breast-bone is connected with the vertebral column by the thoracic ribs, which serve to support the coracoids.

Birds with a keeled sternum are included in the sub-order CARINATÆ, one of the three instituted by Huxley. There are a few forms, such as *Cnemiornis*, a big goose, a flightless genus of enormous size, extinct, and found in Australia in a sub-fossilised state; it is allied to the living *Cereopsis* of that country, to the *Anseres*, the Dodo, and the Weka, a flightless Rail of New Zealand, with corresponding modifications of structure incident to birds which have lost their powers of flight. Another flightless bird of New Zealand is the Kaka, the Ground or Owl Parrot, nocturnal in its habits, and usually remaining on the ground, its comparatively short wings being only used to balance itself in running, or to break its fall when it drops from the tree. It is apparently quite incapable of flight. The clavicles, which in most birds meet and unite to form the furcula (merry-thought), are wanting. The keel, or carina, is present in all the above. The aborted condition of the carina is always an indication of the incapacity of the bird for flight, and may be, as some have surmised, the result of disuse. The sternum is exceedingly strong in birds of powerful flight, as well as in those who use their wings for swimming. The part of the trunk to which the hind-limbs are attached consists of several anchylosed vertebræ. The ilium, ischium, and os-pubis, which in reptiles are separate

elements, are similarly anchylosed, together with the sternum, coracoid, scapula, and clavicle, which comprise the pectoral-arch. The coracoid is one of the most characteristic bones of a bird. It has a process at the upper end, on which the proximal portion of the clavicle rests. The scapula (shoulder-blade) is pointed at the distal end. This bone and the coracoid are in the Dodo; they are anchylosed together, which might have been regarded as a compensation for the loss of flight had it not been that a similar fusion is observable in a very marked manner in the Frigate-bird (*Phaethon*), which the late Professor Mivart showed to be distinct from the Pelicanidæ, while its osteology differs in a very remarkable manner from all other known birds. The furcula coalesces firmly at its symphysis with the carina of the sternum and with the coracoids, the anterior end of each coalescing with the proximal end of the scapula. Thus, the only articulations in the whole sternal apparatus are where the coracoids meet the sternum, and constitute a bony framework, which would be perfectly rigid were it not for the flexibility of the rami of the furcula, giving them a limited amount of motion. To this mechanism may be attributed the faculty of soaring for a considerable time in the air with scarcely any perceptible movement of the wings; but the particular way in which it works has yet to be explained.

The posterior limb of a bird, as in the land mammalia, consists of the femur, tibia, and fibula, the carpals, metacarpals, and the digits. The axis of the femur is almost at right angles to the body of the bird; this is the case with the *Iguanodon* and other ORNITHOSCELIDÆ, but not with ordinary reptiles. There is a prominent ridge at the proximal end of the tibia and fibula, which is conspicuous on the surface of the outer condyle. A similar ridge is faintly developed in some of the LACERTILIA, but is well marked in the DINOSAURIA. The fibula of birds is always imperfect; it is usually shorter than the tibia. Many birds have only three toes through the suppression of the hallux and the fourth digit. In the Ostrich not only is the hallux missing, but the second digit also. Consequently, the foot has only two functional toes. In

most of the four-toed birds the hallux is turned completely backward, while the other three digits have a forward direction. Again, the outer toe of many birds of prey, the Owl especially, can be turned inward or outward at will; in Parrots, Cuckoos, Woodpeckers, and other scansorial birds it is permanently reversed. With most birds the air-sacs of the lungs send off prolongations into the bones of the skeleton. The amount of pneumaticity of the bones of a bird by no means expresses the development of the power of flight. For instance, the bones of the Ostrich are more pneumatic than those of the Gull. The lightness of the body of a bird is favourable to capability of raising and supporting itself in the air. The specific lightness principally depends upon the presence of air-cells. The feathers, especially the quill feathers, as we have seen above, are light, elastic, and firm, which contribute to their buoyancy in proportion to the length and breadth of the vane. Thus the wing apparatus enables the bird to move with more or less rapidity through the air. The head is usually small with a pointed beak—a provision to facilitate its progress through the air. On the land most birds accomplish locomotion by the alternate movement of the right and left leg, preserving their centre of gravity by a corresponding movement either of the head and neck, as with Gallinaceous birds, or of the tail, as with Rails and Coots.

Most of the Oscines, a sub-order of Passeres, advance by both legs at once with leaps or hops, flexing the joints and propelling the body by sudden extension. Some birds are assisted by their wings in their terrestrial progress. The act of climbing is performed by means of a peculiar disposition of the toes, the fourth being bent back like the first. The grasp of some of these climbers is aided by the prehension of the beak, as is the case with Parrots and Macaws, or by the prop of the stiff feathers of the tail, as with Woodpeckers. The Nuthatch is the only climber which can adapt its movements to running down the tree as well as up; other birds make use of their wings for descent. Swimming birds, requiring an

expanse of the soles of the feet, are furnished with lobes, as in Grebes, Phalaropes, and Coots, or with webs, uniting the toes, as in Ducks, Gulls, &c. The breast and under portion of the body of a bird is boat-like and covered with thick down and closely-imbricated oiled feathers. Much of the body is sustained above the water by hydrostatic pressure and by muscular action required for its horizontal movement. Swans partially expand their wings to the wind when swimming, which act as sails in their progress through the water. The habitual divers, such as the Penguins, Auks, and Cormorants, move through the water by a rapid action of the wings, the outspread tail contributing to sustain the posterior part of the body. By a partial folding of the fan or the tail, or by bending it on one side, it is made to act as a rudder. In the *Anseres*, as well as the Waders, the tail, represented by the caudal quill feathers, is very short, and the office of the rudder is transferred to the legs, which in flight are extended backward, and aid to counter-balance the long outstretched neck and head.

The eyeball of a bird is strengthened by the ossification of the sclerotic tissues, which assume the form of flattened plates disposed in a ring round the cornea, which collectively stiffen the coat of the eye; they are from twelve to twenty in number, their edges overlapping one another. They are situated immediately behind the cornea and preserve the spherity of the eye. Both the sclerotics and the cornea form the exterior coat of the eyeball. The eye of a bird is remarkable for its size in comparison with the head—a feature analogous to some of the flying insects. Its anterior part is more prominent than that of any other animal; those of swimming birds are the least so. The sclerotic plates enable the bird to change the convexity of the cornea. By the compression of the muscles attached to the posterior part of eye, the aqueous fluid is pushed forward and distends the cornea, and adapts the eye for clearly seeing near objects. When the muscles are again relaxed, the aqueous fluid falling back on the posterior part, the cornea becomes flattened in proportion to the diminished muscular action. This extreme

relaxation adapts the eye of a living bird to seeing distinctly objects at a great distance, and by this natural focussing apparatus the convexity of the cornea is made to increase as the bird descends upon its quarry. The accessory parts of the eye of a bird are similar to those of the higher reptiles. There are three eyelids, two of which move vertically (upper and lower), the third horizontally. The lower eyelid is that which generally moves when closing the eyes in sleep. In Owls and Nightjars the eyelids are closed principally by the depression of the upper one. There are but few birds that possess eyelashes; of these the Ostrich is an example, as also the Hornbills and Owls, in which they are arranged in a double series, but they are to be considered as feathers with short barbs rather than true eyelashes. The nictitating membrane of the third eyelid is very highly developed in birds, and can be swept across the whole eye by means of muscles and tendons. Young birds, which commence their lives in a nest and are dependent upon their parents for their food and nourishment until they are able to fly, are hatched with immature eyes covered by film. This is a wonderful provision of Nature and a contrast to those birds which can run about as soon as they emerge from the shell and are able to seek their food under the fostering care of the mother.

The blood of birds differs from that of reptiles in being warm; the colour is deeper red; the corpuscles more abundant, nucleated, and in shape elliptic and flattened. With mammalia the white corpuscles alone are nucleated. The heart consists of two ventricles and two auricles, both of which have a complete septum. The right auricle is much larger than the left. Like reptiles, birds have invariably two pre-canals, which return the blood from the right fore-limb (wing) and the right side of the neck into the auricle of the heart; the blood, thus aerated, is returned from the lungs into the left auricle. This arrangement was foreshadowed in the Crocodilian Order, which was a considerable advance upon the structure of the heart of other reptiles. The venous and arterialised blood from the lungs passes into the

ventricle, from which it is transmitted in a more or less mixed state again to the lungs and the general system. The blood of the Crocodilians passes from the general system into the right auricle by the usual reptilian bivalved aperture. The auricular ventricle is not only defended by the ordinary valve on the left side, which is attached to the base of the auricular septum, but by a similar and smaller fold on the opposite or right side. Thus the heart of this Order consists of two auricles and two ventricles, corresponding to the "right" and "left" auricles and ventricles of mammals. To convert the heart of the Crocodile into that of the Bird it only remains to appropriate the right ventricle exclusively to the service of the pulmonary artery and the left ventricle to the service of the aorta, which in warm-blooded animals is the exclusive distributor of the arterial blood to the general system in an unmixed state.

The earliest birds with which we are acquainted give evidence of an approach to the Reptilia in several of their characters. Professor Huxley remarked, in a lecture read at the Royal Institution in 1868, that "to superficial observation no true groups of beings can appear to be more entirely dissimilar than reptiles and birds. In perfect strictness no doubt it is true that birds are no more modified reptiles than reptiles are modified birds, the reptilian and ornithic types being both in reality somewhat superstructures raised upon one and the same ground-plan; but it is also true that some reptiles deviate much less from that ground-plan than does any bird, and that they might be taken to represent that which is common to both classes without any serious error." Huxley includes in his Order ORNITHOSCELIDÆ the *Megalosauridæ*, the *Scelidosauridæ*, the *Iguanodontidæ*, and the *Compsognathidæ* as possessing, in his opinion, ornithic characters. Similar apparent physiological features cannot be accepted as proofs of affinity in the birds and reptiles. For instance, the form and manner of the connection of the scapula, the coracoid, and the broad-crested sternum of the PTEROSAURIA, have relation to organisation only, rather than to affinity, for these features of resemblance are found only in the birds which

fly, and are absent in the flightless birds, such as the Ostrich and the *Apteryx*. There is an enormous difference between the fore-limb of the first-known fossil bird *(Archæopteryx)*, or that of any of the DINOSAURIA, and the wing of a later bird; the "limb" being modified in a fashion diametrically opposite to that of a "wing." As the palæontology of birds is not as yet fully ascertained, their ancestral line is necessarily very incomplete.

The *Archæopteryx* has been found in the Lithographic stone, Kimmeridgian, Bavaria. In this bird we obtain a clear indication of the process of the change which has produced the true birds, especially in the elongate series of the caudal vertebræ and the persistent digits of the anterior limbs. The vertebræ are either amphicoelian or flat at both ends. Some of the later forms from the Cretaceous beds of Europe and North America, with amphicoelous vertebræ, are furnished with teeth; this feature, however, was soon lost. The wings, feet, and vocal organs subsequently attained to a special development. The development of the feet to adapt them for perching and the power of flight, the special avian characters, were irregularly introduced as the circumstances of their environments required. This is apparent as early as the Upper Cretaceous Age with respect to the toothed birds. According to Marsh the *Hesperornis* had only rudimental wings; those of the *Ichthyornis* were well developed. This is the case with the swimming birds, such as the Frigate-bird and the Albatross, Skuas, Gulls, and Terns. The Humming-bird exceeds all others in its power of flight. Some of the *Caprimulgidæ*, Swifts, and Swallows are highly developed in this respect. The reduction of the size of the feet in these birds is a notable example of the animals' physiological structure being adapted for their special modes of life.

The Class AVES consists of three Orders, SAURURÆ, RATITÆ, and CARINATÆ. Of these, the First, SAURURÆ, is represented by *Archæopteryx*, which was about the size of a Rook. The Lithographic Sandstone of Solenhofen Kimmeridgian is a bed capable of retaining the most delicate impressions, and displaying most

accurately the lamina of the feathers. This ancient bird is characterised by the metacarpals being separate and the caudal portion of the vertebral column being longer than the body, whereas that of recent birds is atrophied, and terminates in a pygostyle. We thus have evidence that feathers were acquired before the disappearance of the skeletral tail and the full development of the pelvis. The atrophy appears to have been almost completed during the later part of the Cretaceous period, but, owing to the paucity of evidence, the progress can only be imperfectly traced. Only two species of the *Archæopteryx* have as yet been found, *A. macrura* and *A. siemensi.* A nearly complete skeleton of the former, except the head, is now in the British Museum. The latter, which is nearly complete, including the head, is in the Berlin Museum, showing several differences in the proportion of the bones. It was first known by the impression of a feather, to which Professor H. Von Meyer gave it the name *Archæopteryx lithographica.* Until we are better acquainted with the birds of the Jurassic Age, its relationship to existing forms cannot be determined. The bill was short and blunt, the upper jaw being furnished with 13 teeth and the lower with 3 on each side, all implanted in distinct sockets. The sternum seems to have been keeled, and the manus had three free digita, each terminating with a claw. The tibia and fibula did not coalesce ; the former was furnished with a series of feathers similar to those of the tail. The form of its feet indicates an arboreal mode of life.

We now arrive at the Second Order, the RATITÆ (raft-breasted birds, having a breast-bone without a keel). The structure of the wing suggests that they are all descended from families which had once the power of flight ; and there are many reasons for supposing that their ancestors were already differentiated into several well-defined groups before the gradual loss of functional wings had commenced. The characters of the pectoral-arch seem to be the result of the degeneration of the wings. The

furcula is incomplete or wanting. All the known Tertiary RATITÆ are running-birds, and unadapted for swimming. *Hesperornis*, an Upper Cretaceous bird, seems to represent a less specialised group of RATITÆ, the *Odontolcœ*, whose habits must have been aquatic. They are so named in allusion to their possession of teeth in grooves. The upper-jaw is furnished with 14 on each side, the lower-jaw with 33. Their roots were implanted in a common groove with projections, which seem to foreshadow alveoles. The teeth were easily detached, and are often found lying beside the jaws. The head is remarkably small. *Hesperornis* is known by nearly complete skeletons. The ramus of the lower-jaw extends into a considerable process behind its articular facette. There are 17 cervical vertebræ out of the 23 pre-sacral, the last three bearing ribs. Fourteen vertebræ are fused together in the much extended sacrum, and the twelve caudals complete the series. The slender clavicles appear to meet in the middle line without fusion. The hind-limbs are adapted for swimming much like the modern Colymbidæ. The genus is known only from the Chalk of the Kansas, United States. The typical species, *H. regalis*, attained the height of a metre. One specimen shows traces of feathers, which appear to have been plumaceous over the whole body, and extended over the tarsals. Remains of *Hesperornis regalis* have been found by Marsh associated with a Pterosaurian (*Pteranodon longiceps*).

ÆPYORNITHES, the second sub-order of the RATITÆ, a family of birds represented by the genus *Æpyornis*, is toothless. This genus of gigantic fossil birds is found in Madagascar; the species is named *Æ. maximus*. It was three-toed. The palæontology of the ordinary Ratite birds is chiefly of interest as demonstrating the much wider geographical range of the Order in the late Tertiary times than that which obtains at present. It also reveals certain extinct genera, which can scarcely be claimed as more primitive than their modern representatives, but which add considerably to the known modifications of which the RATITÆ are capable.

Æpyornis, if not actually gigantic, exceeded the Ostrich in size. Its remains are found in very recent deposits in Madagascar. The egg was some 12 or 14 inches long and of the capacity of six Ostrich's eggs, or about twelve dozen hen's eggs. Specimens of eggs and bones occur abundantly in the superficial deposits of the island. The skull is relatively small, as is usual in the RATITÆ. A number of large pits on the top of the skull seem to indicate an enlarged frontal crest of feathers. There is a distinct glenoid cavity for the humerus, which is short and much reduced and useless for flight. The leg bones are very massive. *Æ. titan* is larger than *Æ. maximus*. *Æ. medius* is a third species and much smaller. This Pleistocene bird, now extinct, was contemporary with man, and may have lived less than 200 years ago, within historic times.

APTERYGIDÆ.—Sub-order *Apteryges*, Shaw. This series is confined to New Zealand. The Kiwi (*Apteryx*). This remarkable bird was unknown until Shaw figured it in 1813 from a specimen brought from the northern coast of New Zealand. Until 1831 no second example was known. The systematic place of this genus as akin to the Struthious birds was placed beyond doubt. The most marked features of the *Apteryges* is the presence of a back toe, the extremely abortive condition of the wings, and the position of the nostrils, which are almost at the tip of the bill. There are three species of this genus, *A. australis*, *A. Mantelli*, and *A. Oweni*. The first two are of a dark reddish brown, longitudinally striped with light yellowish brown, transversely barred with black.

The DINORNITHIDÆ constitute another Sub-order. The extinct Moas survived in New Zealand until comparatively modern times; they were regularly hunted by the Maories, and are known only from dried mummies accidentally preserved in fissures or caves, and from egg-shells met with abundantly in superficial deposits (especially in swamps) and refuse heaps. No remains, hitherto discovered, seem to date back beyond the Pleistocene period. Several genera of this Sub-order are represented. In all of them the wings were exceedingly rudimentary

or entirely wanting: the only known feathers bear a large aftershaft, and in this respect they differ from the *Apteryx*, and resemble the Emeus and the Cassowaries. *Dinornis* is the typical genus of this Sub-order, and comprises the largest known species. The scapular arch is destitute of a glenoid cavity for the humerus. *Dinornis maximus* is the largest species; its total height was about ten feet, and the tibia three feet in length. The southern island of New Zealand has furnished such a quantity of the bones of the Moa that they have supplied not only the Museum of Canterbury, New Zealand, with perfect skeletons, but also nearly all the Palæontological Museums of Europe and North America. Occasionally every bone of the individual bird has been found, and even the feathers with portions of the skin. Seventeen or eighteen species have been recognised by Professor Owen. The vertebræ are nearly sixty in number, one-third of which are cervical, and have the ischium, ilium, and pubis of the sacrum anchylosed. The scapular arch is reduced to a long scapulo-coracoid-bone on each side. The femur is comparatively long and has a medullary cavity with very thick walls. The typical species is *D. novæ-Zealandiæ* (*giganteus*). *D. maximus* is larger and is the best known of this genus. Professor Owen has described no less than sixteen species of these extinct running birds, varying in size from three to upwards of ten feet in height, some being tall and slender and probably swift-footed, like the living ostrich, while others are short and stout-limbed, as *Pachyornis elephantopus*, a bird undoubtedly of great strength and with ponderous feet.

Dinornis has been found in a Pliocene deposit in N.E. Australia. This is a very important discovery, as it supports the theory of a great eastward extension of Australia in Tertiary times.

The prevalence of birds in New Zealand, either without wings or with wings too feebly developed for the purpose of flight, is associated with the absence in those islands of any higher form of life adapted for their destruction, until the immigration of man. The abortive wings of such birds, like the eyes of animals living

in dark caverns from which all light is excluded, or fishes inhabiting the abysmal depths of the ocean, would seem to have degenerated through lack of use; while their legs, by which locomotion was exclusively exercised, gained in size and strength. Lamarck affirmed that variations would occur and keep pace with the continuous operation of causes producing them; and that changes of form and structure would produce corresponding changes in actions, whilst a change of action, when habitual, becomes another cause of altered structure. He also held that the more frequent employment of certain parts or organs leads to a proportional increase of development of such parts, and that, as the increased exercise of one part is accompanied by a corresponding disuse of another, this very disuse, by inducing a proportional degree of atrophy, becomes an additional factor in the changes of organic forms. Changes of climate and nutrition affecting their sustenance may lead to modification and in some cases to destruction.

Stereornithes.—A new Order of Birds proposed by Moreno and Mercerat, from remains mostly of gigantic size, found within the last ten years in the Tertiary strata of Santa Cruz, Patagonia. These are now referred to two genera, *Phororhacos* and *Brontornis*, both included in the family Phororhacidæ, and placed by Dr. Ameghino among the Ratitæ. Professor A. Newton considers the retention of Stereornithes desirable, and believes that the Santa Cruz Beds are probably not older than the Upper Oligocene. The validity of the Stereornithes is admitted and nine genera referred to it—*Phororhacos*, with three species, *Brontornis* with one or two, and the others with one each, all, except *Opisthodactylus*, which is regarded as belonging to a distinct family, being grouped with the Phororhacidæ. The most striking peculiarity of the Stereornithes is the enormous size and ponderous structure of the skull, which is quite unlike other birds, and seems entirely out of proportion to the limbs, gigantic as are some of the limb-bones. The upper jaw is remarkable for its extreme lateral compression and great depth, its extremity terminating in a hook, while that of the lower jaw turns upward.

The furcula are very slender, and almost rudimentary; yet the wings, though relatively small, are completely developed. The whole length of the lower jaw of *P. longissimus* is about 21 inches. That the STEREORNITHES were flightless may be considered certain, but whether they should rank as a sub-class with the RATITÆ and CARINATÆ cannot as yet be determined. Vögel placed the European *Remiornis*, *Gastornis*, and *Dasornis* together with the N. American *Diatryma*, all being Eocene forms.

Anomalopteryx.—Small birds of comparatively slender build. *A. parva* is the smallest known member of the DINORNITHIDÆ, the species being founded upon a nearly complete skeleton, scarcely three feet in height. Other genera commonly recognised among the DINORNITHIDÆ of New Zealand are named Emeus (*Megalapteryx*). There is no certain evidence of the occurrence of the family in Australia or elsewhere.

Sub-order CASSUARIIDÆ. — The Casowary resembles the Ostrich, and is nearly as large, but has shorter and thicker legs in proportion, with three toes. It is characterised by a Ratite sternum, plumage with large aftershafts rudimentary wings represented by several spine-like processes, fleshy lappets upon the throat, and a large casque on the head. After laying its few eggs it leaves them to be hatched by the heat of the sun. There are nine species, some of which are found in North Australia, New Guinea.

Palæontology adds but little to our knowledge of the distribution of the Emeus and Cassowaries. An extinct Emeu (*Dromæornis*) is known by fragmentary remains from the superficial deposits of eastern Australia. The Order is characterised by certain structural peculiarities in the base of the skull, the presence of only one digit in the fore-limb, which is furnished with a claw; pubis and ischia not united by a symphysis. The family *Dromæidæ* represented by the existing Emeu (*Dromæus*) of Australia, and by fossil species in the Pleistocene of that country.

Dromaeus Sivalensis, Lyd., has been reported from the Lower Pliocene of the Siwalik Hills in India.

Sub-order RHEÆ.—The *Rheidæ*, which alone form this group and are confined to South America, differ from the Megistanes by the longer humerus by the presence of three digits (of which two are clawed) in the fore limb, by the symphysis of the ischia and by the absence of an aftershaft of the feathers. Remains of *Rhea*, which are referred to the existing species, occur in the Pleistocene deposits of Brazil.

Sub-order STRUTHIONES.—The Family *Struthionidæ* is the sole representative of this sub-Order, the only existing species being the Ostrich (*Struthio camelus*), which is now confined to Africa and Arabia, though it formerly ranged into Persia, and probably also Baluchistan and the north-west frontier of India. *Struthio* differs from *Rhea* by the union of the pubes in a ventral symphysis, and also by the suppression of the second digit of the foot. It is represented in the Pliocene Siwaliks of India, and also in the Lower Pliocene of the Isle of Samos, by remains belonging to two species. These fossil-forms point to the conclusion that the original home of the genus was probably in Asia.

There is some reason to believe that other RATITÆ, of an extinct primitive type, ranged into the northern hemisphere, both in Europe and America, during the early Tertiary period. *Gastornis*, from the Lower Eocene of Western Europe, is regarded as a Ratite bird. The remains of *G. Parisiensis* have been found at Meudon, near Paris, *G. Edwardsi*, from the same horizon, at Rheims, and *G. Klasseni*, from Croydon. The wings are somewhat larger than those of the Ostrich, and the alveolar margins of the jaws serrated, as in the genus *Odontopteryx*. The huge *Diatryma* from the Lower Eocene of North America appears to be closely allied to, if not identical with, *Gastornis*.

With the exception of the Ostrich, which has spread northward into the Palæarctic region, the Struthious birds, living and extinct are confined to the Southern Hemisphere, each continent having its own peculiar forms. It is a remarkable fact that the most nearly allied genera, *Struthio* and *Egea*, should be found in Africa and South Temperate America respectively. Equally

remarkable is the development of these large forms of wingless birds in Australia and the adjacent islands, and especially in New Zealand, where we have evidence which renders it probable that about twenty species recently co-existed. This points to the conclusion that New Zealand must not long since have formed a much more extensive land, and that the diminution of its area by subsidence has been one of the causes, and perhaps the main cause, in bringing about the extinction of many of the larger species of these wingless birds.

The wide distribution of the STRUTHIONES may be best explained by supposing them to represent a very ancient type of bird, developed at a time when the more specialised carnivorous mammalia had not come into existence, and preserved in those areas which were long free from such dangerous enemies. Struthious remains in the European Eocene support this view; for at this time carnivora were few and of generalised type, and had not acquired sufficient speed and activity to exterminate powerful and quick-running terrestrial birds. We may, however, expect to find the remains of the earlier forms of this group at a much more remote epoch. These Eocene birds may, perhaps, represent that ancestral wide-spread type, which, in remoter continents and islands, became modified into the African and American Ostriches, the Emeus and Cassowaries of Australia, the *Dinornis* and *Æpyornis* of New Zealand. At the same time the ancestral Struthious type may, like the Marsupial, have once spread over the larger portion of the globe; but as higher forms, especially those of the CARNIVORA, became developed, it would be exterminated everywhere, except in those regions where it was free from their attacks. In each of such regions this type would develope into special forms adapted to surrounding conditions, and the large size, great strength, and excessive speed of the Ostrich may have been a comparatively late development, caused by its exposure to the attacks of its enemies, which rendered such modification necessary. This, Dr. A. Russel Wallace considers the most probable explanation of the distribution of Struthious birds, amounting almost to

certainty by the discovery of remains of this Order in Europe and in Eocene deposits, and also by the occurrence of an Ostrich among the fossils of the Siwalik hills. He adds, however, that it is just possible for the ancestral type to have been a bird capable of flight, and to have spread from one of the three southern continents to the others at the period of their near approach, losing completely the power of flight by reason of the long continued absence of enemies.

Order CARINATÆ.—The earliest distinctly Carinate birds of which there is any precise information are the toothed *Ichthyornis* and *Apatornis* from the Upper Cretaceous of North America, both of which are extinct. The Order is now by far the most numerously represented, and is generally characterised by the presence of a median keel to the sternum. In most cases the wings are adapted for flight, but in some instances they are atrophied, while in others they are modified into swimming organs. Mr. Lydekker says "Before noticing those fossil-forms which are susceptible of being placed in definite groups, it will be advisable to mention briefly certain remains of which the affinity has not yet been determined. In England the oldest known bird remains occur in the Cambridge Greensand, and have been named *Enaliornis*, although it is quite probable that they may indicate more than one genus. The bones from the Cretaceous of Europe, described as *Palæornis*, *Cimoliornis*, and *Cretornis*, belong to *Ornithosaurus*. In the Tertiary there are *Eupteornis* and *Remiornis* from the Lower Eocene of Rheims; while the Upper Eocene (Lower Oligocene) of Hampshire has yielded *Macrornis*."

From beds older than the Eocene we obtain no remains of birds in the European strata, till we come to the *Archæopteryx* from the Upper Oolite of Bavaria, already described. North America has furnished a number of bird-remains in the Tertiary and Cretaceous deposits of the United States; but comparatively few are terrestrial forms. The *Picariæ* (Woodpeckers) are represented by *Uintornis* from the Eocene of Wyoming. Species of Turkey *(Meleagris)* occur in the Post-Pliocene and as far back

as the Miocene. The other birds are Raptorials, Waders, and Swimmers of existing genera, and a number of extinct forms, such as *Aletornis*, an Eocene wader; *Palæotringa*, allied to the Sandpipers, and *Telmatornis*, to the Rails, both Cretaceous. The caverns of Brazil produced thirty-four species of birds, most of them referable to Brazilian genera, and many to still existing species, the most interesting of which are two Rheas, one larger than any now living, also a large Turkey-buzzard *(Cathartes)* and a new species of the isolated genus *Opisthocomus*, the Hoazin. *O. cristatus* is the sole representative both of the Family and the Order. The anomalies of its structure are such that it is impossible to attach it to any other Family. It is one of those survivors which tell us of extinct groups, of whose past existence we should otherwise, perhaps, remain for ever ignorant.

In England the oldest known bird-remains occur in the Cambridge Greensand, and have been named *Enaliornis*.

Sub-order ODOSTORMÆ.—The teeth are fixed in distinct sockets. The rami of the mandible are only loosely united, and the vertebræ are all amphicœlian.

Ichthyornis, about the size of a Rock Pigeon, is a small bird, known only by imperfect specimens. The bill is elongated, and the premaxillæ appear to have been toothless, but teeth occur in distinct sockets in the maxillæ and throughout the whole length of the dentary bone. There are twenty teeth in each jaw, which are directed obliquely backwards. *Ichthyornis* has only been found in the Cretaceous of Kansas, North America, and perhaps of Texas. The typical form is *I. dispar*.

TOOTHLESS SERIES.—In this series, which comprise all existing Carinates, no teeth are ever functionally developed, although germs occur in the young of one group. The extinct representatives of the modern Carinate birds are too imperfectly known to be noticed here in detail.

The *Impennes* (Penguins) are known by fossils only in the southern regions they now inhabit, and these afford no information concerning their ancestry. The Albatrosses (*Diomedia*)

were more widely distributed in the Pliocene period than at present. Portions of the hind-limbs of an extinct species have been found in the Red Crag of Suffolk. The extinct Rails of New Zealand (*Aptornis*), of the Chatham Islands (*Diaphorapteryx*), and of Mauritius (*Aphanapteryx*) are of much interest on account of their close affinities to each other and to the living *Ocydromus* of New Zealand. Gigantic extinct raptorial birds, which may be related to the Cariamas (*Phororhachos*), occur in Tertiary strata in Patagonia. The Dodo (*Didus*) and Solitaire (*Pesophaps*) are large extinct Ground Pigeons, whose remains occur in the surface deposits of Mauritius and Rodriguez respectively. *Palæolodus* a form allied to the Flamingoes is very common in the Miocene of the Allier, France. A fish-eating bird, apparently related to the Gannet (*Sula*) is represented by an imperfect skull from the London Clay (Lower Eocene), of Sheppey, Kent. This is named *Odontopteryx toliapicus*, and is remarkable for the denticulation of the jaw. A second skull from Sheppey (*Argillornis longipennis*) seems to belong to the same group, but is too imperfect to show the precise character of the jaws. A Secretary Vulture, with somewhat stouter limbs than the South African form, occurs in the Miocene of the Allier, and there seems to be an ancestral Trogon (*Archæotrogon*) in the Upper Eocene of Southern France. A Parrot (Psittacus verreauxi), rather smaller than the Grey Parrot, is also recorded from the Allier.

Sub-order CRYPTURI (Tinamous, &c.), which constitute the third sub-Order, show more signs of affinity to the RATITÆ in the structure of the pelvic and skull, than any other group of the Order. The beak is long, slender, and straight, the wings very short. They are now confined to South and Central America, and are represented in the fossil state by remains of existing species of *Crypturus*, *Nothura*, *Tinamus*, *Rhynchotus*, and *Porphyrio* in the Pleistocene cave-deposits of Brazil.

Sub-order IMPENNES.—The Penguins (*Aptenodytes*), &c., of the Antarctic regions, form a peculiarly interesting and well-defined group of birds, in which the wings are modified for

swimming. It has been recently proposed that the IMPENNES should form a primary group of equivalent rank to the CARINATÆ, under the name of EUPODORNITHES. Scarcely anything is known of their palæontological history, the only fossil type being *Palæeudyptes* from the Tertiary of New Zealand.

Sub-order TUBINARES.—The Petrels or *Procellarilidæ* are the only family of the group. The only fossil representatives are members of the existing genus *Puffinus* (Shearwater), which have been recorded from the Lower Miocene of Allier in France, and also from the Tertiary of New Zealand.

Sub-order PYGAPODES.—Of this sub-Order, the *Alcidæ* or Auks include the Great Auk (*Alca impennis*) of the Arctic regions, which now appears to be entirely extinct, but of which the remains are found abundantly in the peat and other superficial deposits of Northern Europe. Remains referred to the genus *Uria* (Guillemots) are found in the Upper Pliocene of Italy, and Guillemots occur also in the Tertiary of the United States, where they have been described under the name of *Cattarractes*. Amongst the *Colymbidæ*, which include the Grebes and Divers, remains of the Great Northern Diver (*Colymbus glacialis*) are found in the Pleistocene deposits of Mundesley, in Norfolk, while the extinct *Colymboides* of the Lower Miocene of the Allier appears to be an allied form. *Colymboides minutus* has been procured from the Miocene of the Limagne, Allier, and *Podiceps occidentalis* from the Pliocene of Oregon.

Sub-order GAVIÆ.—Of the *Laridæ* (Gulls and Terns), a species occurs in the Miocene of the Limagne of the Allier. *Hydriornis*, of the same deposit, may be probably referred to the same Family.

Sub-order LIMICOLÆ.—The Limicolæ are somewhat abundantly represented in the Tertiary deposits; the sub-aquatic habits of its members being probably conducive to the preservation of their remains. In the Family of *Scolopacidæ*, the genus *Numenius* (Curlew) is recorded from the Middle Miocene of Gers, in France, and the Pliocene of Italy. *Limosa* (Godwit) occurs in the Upper Eocene (Lower Oligocene) of Montmartre;

Totanus (Redshank) in the Miocene of the Allier, France, and the Pliocene of the Val d'Arno, in Tuscany; *Tringa* (Knot and Dunlin), probably in Montmartre, and certainly in the Allier beds and the equivalent deposits of the Mayence basin. *Elornis* is an extinct genus from the Allier, probably allied to *Limosa*. The Woodcock *(Scolopax rusticola)* has left its remains in the Pleistocene of Westphalia, and a species of *Himantopus* (Stilt) is found in the Miocene of the Allier. In the Family *Charadriidæ* (Plovers) a species of the type-genus, *Charadrius*, occurs in the Upper Eocene of Colorado.

Sub-order ALECTORIDES.—The Alectorides form a somewhat undefined group, which is taken by Sclater to include the *Otididæ*, although Professor Newton regards the latter as more nearly allied to the Gaviæ and Limicolæ. The Family *Gruidæ*, or Cranes, is represented by the type-genus, *Grus*, in the Pleistocene of Europe, India, and the United States, and also in the Lower Pliocene Pikermi beds of Greece, and the Miocene of the Allier. The *Otitidæ* are represented by a species of Bustard *(Otis)* in the Miocene of the Allier.

Sub-order FULICARIÆ.—This sub-Order comprises the Rails, Coots, Water-hens, &c., all of which are included in the single Family *Rallidæ*, and are of more or less aquatic habits. Birds referred to the type-genus, *Rallus* (Rail) occur in the Eocene of Montmartre, the Miocene of the Allier and Gers, and the Italian Pliocene. Remains of *Gallinula* (Water-hen) are recorded from the Pleistocene beds of Brazil and Queensland, in both of which deposits we meet with others referred to *Porphyrio* (Purple Water-hen), a genus now widely distributed over the warmer regions of the globe. An extinct species of Coot (*Fulica*) has also been described from the Queensland Pleistocene. *Notornis*, which occurs in the Pleistocene of New Zealand, and was found living there some years ago, is a large Rail allied to the Australian *Tribonyx;* while *Aptornis*, which is a very large form from the same deposits, totally incapable of flight, is more nearly related to the existing *Ocydromus* of New Zealand. *Aphanapteryx*, from the Pleistocene of Mauritius and Rodriguez,

is another large Rail allied to *Ocydromus*. Lastly, *Gypsornis*, of the Montmartre Eocene, is considered to be the earliest representative of this Family.

Sub-order GALLINÆ.—The Gallinæ form a large group of birds, to a considerable extent living on the ground, and of comparatively stout build. They comprise the Families *Megapodidæ* (Megapodes), *Cracidæ* (Currassows and Guans), *Phasianidæ* (Pheasants and Turkeys, &c.), *Tetraonidæ* (Grouse). The Gallinæ, together with the following group of COLUMBÆ, were formerly bracketed together under the name of Rasores, and it is by no means certain that the departure from this arrangement is an advisable one. Many of the genera of *Gallinæ* (especially the males) are characterised by the presence of one or more strong bony spurs. The Curassows and Megapodes are at present unknown in a fossil condition. In the *Phasianidæ* the typical genus *Phasianus* occurs in the Miocene deposits of the Allier and Gers, and also in the Lower Pliocene of Pikermi. *Francolinus* (Francolin) is represented by the remains of existing species in the Pleistocene of Southern India; *Coturnix* (Quail) in the Montmartre Eocene gypsum, the extinct *Palæoperdix* of the Mayence Miocene being probably identical; while a species of *Gallus*, somewhat larger than the existing Indian *G. sonnerati*, is found in the Pikermi Pliocene. From the Miocene of the United States a Turkey (*Meleagris antiqua*) has been recorded, and is described as equal in size to the living species now characteristic of America. In the *Tetraonidæ*, remains of the living Capercaillie (*Tetrao urogallus*) occur in the Norfolk Forest-bed, while an extinct species of the same genus has been described from the Upper Eocene of Languedoc. Remains of the existing Willow Grouse (*Lagopus albus*) are found in the Pleistocene of Westphalia.

Sub-order COLUMBÆ.—This group is taken to include existing Sand Grouse (*Pteroclidæ*) and the Pigeons (*Columbidæ*). In the first-named family a species of the type-genus, *Pterocles*, has been described from the Miocene of the Allier. The *Columbidæ* are known by a species referred to *Columba* from the last named

deposits, as well as another provisionally referred to the same genus from the Pleistocene of Rodriguez; also the remains of a bird allied to the Crowned Pigeons (*Goura*) of New Guinea, from the Pleistocene of Queensland. *Goura* shows some affinity to the *Phasianidæ*. Here also may be placed the now extinct family *Dididæ*, represented by the Dodo (*Didus ineptus*) of Mauritius and the Solitaire (*Pezophaps solitarius*) of Rodriguez. Of these two singular birds, the Dodo inhabited Mauritius in great numbers; the last record of its occurrence dates from the year 1681. It was a large and heavy bird, bigger than a Swan, and utterly unlike the Pigeons in appearance. The wings were rudimentary and completely useless as organs of flight. They had four toes each, and the tail was extremely short, carrying, like the wings, a tuft of soft plumes. The beak, unlike that of any of the Columbæ, except the little *Didunculus strigirostris*, was arched towards the end, and the upper jaw had a strongly-hooked apex, not unlike that of a bird of prey. The brain-case was very small in proportion to the size of the cranium. The last appearance of the Solitaire was in the year 1693; this bird was in many respects allied to the Dodo, and, like it, incapable of flight. It had longer legs and neck; the bill was less arched. Both these birds are known to us by nearly entire skeletons, obtained recently from the islands which they inhabited. Remains of existing species of several genera of *Columbidæ* are found in the Pleistocene cave deposits of Brazil.

Sub-order ANSERES.—All the existing members of this group are referred to the Family *Anatidæ*. A peculiar sub-family is represented by the living *Cereopsis* of Australia; allied to which is the much larger extinct *Cnemiornis* of the Pleistocene of New Zealand, which was quite incapable of flight. In the sub-family *Anserinæ* remains of the Grey Lag Goose (*Anser cinereus*) occur in the European Pleistocene. The *Cygninæ*, or Swans, are represented by the extinct *Cygnus Falconeri* from the Pleistocene cave-deposits of Malta. Cope, in his "Description of now extinct Vertebrata from the Upper Tertiary and Dakota Formations," mentions *Cygnus pelagornis*. It was discovered in

the Pliocene of Oregon, associated with a new species of Cormorant (*Graculus macropus*), together with other birds now living in North America. Among the *Anatinæ* (Ducks) an extinct species of Tree-duck (*Dendrocygna*) is recorded from the Pleistocene of Queensland. Remains of the Wild-duck (*Anas boscas*) occur in the Pleistocene of Europe; *A. atavæ* and *A. cygniformis* are found in the Middle Miocene of Bavaria, the latter species being nearly as large as a Swan; *A. œningensis* from the Upper Miocene of Switzerland; *A. lignitifila* from the Middle Miocene of Italy; and *A. blanchardi* from the Miocene of the Allier. Remains of the Shoveler Duck (*Spatula clypeata*) have been found in the Norfolk Forest-bed. In the *Fuligulinæ* the type-genus, *Fuligula* (Pochard), is recorded from the Upper Pliocene of the Val d'Arno, in Italy, and *Nyroca* (White-eyed Duck) from the Pleistocene of Queensland, and it is probable that *Mergus* (Merganser) is represented in the Pliocene Siwaliks of India.

Sub-order ODONTOPTERYGES.—The *Odontopterygidæ* represented by *Odontopteryx*, of the London Clay, appear to indicate a distinct sub-ordinal group, which may be provisionally placed here. In this bird the alveolar margins of both jaws are furnished with tooth-like serrations, which differ from true teeth in being actually parts of the bony substance of the jaw itself. They are of triangular or compressed conical form and of two sizes. Upon the whole, *Odontopteryx* would appear to be mostly allied to the *Anatidæ*, but the serration of its jaws is an entirely unique character unknown in any existing type.

Sub-order ODONTOGLOSSÆ.—The only Family of this group is the *Phœnicopteridæ* (Flamingos), which are long-limbed waders, distinguished by a downward bend of beak, and presenting characters connecting them on the one hand with the *Anseres* and on the other with the *Herodiones*. The existing genus, *Phœnicopterus*, is found in the Miocene of the Allier, while in the same beds, as well as in the equivalent deposits of the Mayence basin, and also in the somewhat higher strata of Steinheim, in Bavaria, occurs the peculiar genus *Palælodus*. The latter, while

apparently allied to *Phaenicopterus*, shows some affinity to the *Limicolæ*, and also exhibits one osteological feature now only found among the *Pygopodes*, in *Podiceps* (Grebes) and *Colymbus* (Divers). *Elornis*, from the Lower Miocene of Ronzon, appears to be allied to the Flamingos; while *Agnopterus*, from the Upper Eocene of Montmartre, may perhaps be included in this group.

Sub-order HERODIONES.—This sub-Order includes the *Plataleidæ* (Spoonbills and Ibises), the *Ciconiidæ* (Storks), and the *Ardeidæ* (Herons), all of which are waders. The *Plateleidæ* are represented in a fossil state by the extinct species of Ibis (*I. pigana*), from the Miocene of the Allier and Steinheim; while the existing Asiatic Black-headed Ibis (*I. melanocephala*) has left its remains in the Pleistocene cave-deposits of Southern India. Another existing species of this genus occurs in the cave-deposits of Brazil. In the *Ciconiidæ* the Indian Siwaliks have yielded a giant Stork, of which the genus has not been determined. An extinct species of *Leptoptilus*, which includes the giant Adjutant Stork of India, is found in the Siwaliks, and another in the Middle Pliocene of Bavaria. In the *Ardeidæ*, the type-genus, *Ardea* (Heron), is represented in the Bavarian Miocene by a species (*A. similis*) apparently allied to, but rather stouter than, the common Heron (*A. cinerea*), and remains of the same genus also occur in the Miocene of the Allier and Gers. The Night Herons (*Nycticorax*) are known by an extinct species in the Pleistocene deposits of the Island of Rodriguez. Certain remains from the London Clay may possibly indicate that the Family dates from that epoch.

Sub-order STEGANOPODES.—This sub-Order includes a number of web-footed birds, such as the Darters (*Plotidæ*), Cormorants (*Phalacrocoracidæ*), Albatrosses and Frigate-Birds (*Frigatidæ*), and the Pelicans (*Pelicanidæ*). The *Plotidæ* are only known in a fossil state by a species of the one genus, *Plotus*, from the Pleistocene of Queensland. In the *Phalacrocoracidæ* we find the type genus *Phalacrocorax* in the Eocene of Montmartre, the Miocene of the Allier, the Pliocene of the United States, and probably also in the Indian

Siwaliks. Remains of the existing Cormorant (*P. carbo*) are found in the Norfolk Forest-bed. The Gannet (*Sula*) occurs in the Miocene beds of Colorado and of Ronzon (Puy-en-Velay), France; while *Pelagornis*, of the Miocene of the Allier, is provisionally placed in this Family. In the *Fregatidæ*, remains of a *Diomedia*, apparently closely allied to the Albatrosses of the Southern Seas, have been described from beds at the top of the Suffolk Crag; while it is considered probable that *Argillornis*, of the London Clay, indicates the existence of this family in the Lower Eocene. Amongst the *Pelicanidæ*, remains of the true Pelicans (*Pelicanus*) occur in the Miocene of the Allier and Bavaria, as well as in the Indian Siwaliks.

Sub-order ACCIPITRES.—The *Accipitres*, or Diurnal Birds of Prey, are characterised by a curved beak, the absence of a circle of feathers round the eye, and powerful talons. The *Cathartidæ*, or American Vultures, are represented by existing species of *Cathartes* and *Gyparchus* in the Pleistocene of the Brazilian caves. It has also been conjectured that this group is represented in Europe by *Lithornis vulturinus*, of the London Clay, an opinion which, if confirmed, will be of considerable interest from a distributional point of view. The *Serpentariidæ*, or Secretary Vultures, of Africa are known by a species of the one existing genus *Serpentarius* from the Miocene of the Allier. Of the *Falconidæ*, the *Vulturinæ*, or true vultures, are represented in the Pleistocene breccia of Sardinia by remains of the typical genus *Vultur*; while those of the existing Afro-Indian *Neophron percnopterus* are recorded from the equivalent cave-deposits of southern India. *Milvus* is recorded from the Miocene of the Allier, and also from the Miocene of Montmartre; species referred to *Aquila* are mentioned both from Miocene of the Allier and Gers, and the Sardinian Pleistocene; *Haliaetus* is also recorded from Gers. The largest known member of this sub-Order is *Harpagornis*, from the Pleistocene of New Zealand, which is apparently allied to the Harrier family.

Sub-order STRIGIDÆ.—The *Striges*, or Owls, were formerly grouped with the *Accipitres*, but are now regarded as being

probably more nearly allied to the Parrots. Comparatively few fossils are known. The great Eagle-Owl (*Bubo ignavus*) occurs in the Norfolk Forest-bed, and the existing Indian *B. coromandus* in the Pleistocene of Madras. The genus is also recorded from the Miocene of the Allier, and is represented in the Eocene of the United States by *B. leptosteus*. The Great Snowy Owl (*Nyctea scandiaca*) occurs in the Pleistocene of Westphalia.

Sub-order PSITTACI.—The Parrots and Cockatoos and their allies, which constitute this sub-Order, are now confined to the warmer regions of the globe, and are remarkable for their power to move, by articulation, the upper mandible upon the cranium. All the genera belong to the group *Scansores* (climbers), and have a hallux. Of the true Parrots, remains from the Miocene of the Allier have been referred to the typical genus *Psittacus*. *Lophopsittacus* is an extinct genus from the Pleistocene of Rodriguez. Remains of the genus *Nestor*, a name applied to a small but remarkable group of Parrots peculiar to the New Zealand region, of which *Nestor meridionalis*, the "Kaka" of the Maories in New Zealand, is the type, have been discovered. About the middle of last century this group of Parrots became extinct, and, although some of its congeners still exist in the less frequented and Alpine parts of New Zealand, *Nestor productus* seems to have been confined to Philip Island; the last known to be in existence was about the year 1851. The American Macaws are represented by species of *Ara* in the Brazilian cave-deposits. In the Palæornithidæ, which includes the Lories and Parakeets, an extinct species of the existing genus *Palæornis* occurs in the Pleistocene of Rodriguez, which has also yielded the extinct *Necropsittacus*. So far there has been no record of the Cockatoos of Australia in a fossil state.

Sub-order PICARIÆ.—The *Picariæ* form an heterogeneous group of birds, of which only a few are definitely in a fossil condition. The *Leptosomatidæ* of Madagascar, which connect the *Coracidæ* with the *Cuculidæ*, are represented by a species of the type genus *Leptosoma* in the Miocene of the Allier. *Limnatornis* from the same beds is referred to the Hoopoes, while it is

considered that *Cryptornis*, from the Upper Eocene of the Allier, may belong to the Hornbills of the Ethiopian and Oriental regions. The *Alcedinidæ*, or Kingfishers, are represented in the London Clay by *Halcyornis*, while of the *Picidæ* (Woodpeckers) the existing genus *Picus* occurs in the Middle Miocene of the Allier and the extinct *Uintornis* in the Eocene of Wyoming. Finally, the *Cypselidæ*, or Swifts, are known to have existed since the Miocene of the Allier, where we find a species of the type genus *Cypselus* closely allied to existing forms.

Sub-order PASSERES.—The *Passeres* are the most highly organised and the largest in number of living genera and species, but scarcely anything is known of their palæontological history. To the *Alaudidæ* (Larks) has been provisionally referred *Protornis*, from the Lower Eocene of Glarus in Switzerland, and *Alauda* is recorded from the Upper Pliocene of Italy. Of the *Corvidæ* (Crows) the type-genus *Corvus* has been described from the Miocene of the Allier. In the Pleistocene of Rodriguez the extinct *Necropsar* was a member of the Starling family, closely allied to the pied and crested *Fregilopus* of Reunion, which also appears to be recently extinct. Among the *Fringillidæ* (Finches) *Loxia* is provisionally recorded from the Miocene of the Allier, and to this family perhaps may be referred the extinct genus *Palæospiza* from the Upper Eocene of Colorado. We find also a representative of the *Laniidæ* (or Shrikes) in a species of *Lanius* from the Miocene of the Allier, while the *Sittidæ* (Nuthatches) date their existence from the fossil *Sitta* of the Eocene of Montmartre; they are also represented by a species in the Upper Pliocene of Italy. The cave-deposits of Brazil have yielded remains of several existing forms of PASSERES, among which it will suffice to mention a species of Swallow (*Hirundo*).

The History (Recent and Palaeontological) of the Roe-deer
(Capreolus Caprea).

By J. C. MANSEL-PLEYDELL, Esq., D.L., F.G.S., F.L.S.

(Read Dec. 3rd, 1901.)

Recent.

THE roe-deer has a wide geographical distribution, and is found throughout temperate Europe and Asia, including Great Britain, France, Belgium, Germany, Austria, Spain, Portugal, Italy, Greece, Switzerland, Russia (European and Asiatic), Turkey (European and Asiatic), Persia, and China. It reaches its most northern limit in Scotland, and is replaced in the mountainous districts of Turkestan between Russia and China by the Tartarian roe, *C. pygargus*, distinguished by being larger, and the white shield behind smaller. Like the *red-deer*, it is indigenous to these islands, but since the Roman occupation it has been exterminated south of the Grampians ; before that date there is abundant evidence of its existence in this country. Charles I. stocked the Royal Park of Wimbledon with roe-deer from Northumberland. There is historical evidence of it in Durham, Lancashire, Yorkshire, Leicestershire, Norfolk, Suffolk, Cambridgeshire, Hampshire, and Devonshire. There are records

of it in Wales in the reign of Queen Elizabeth. It frequented the Isle of Ely at the time of the Conquest, which, the historian tells us, "Furnished large pasturages for flocks and herds, fowl and fish, and that harts, hinds, roes, and hares were abundant." Anyone convicted at that date of killing a wild boar, stag, or roe-deer was liable to the loss of his eyes.

In the year 1123 Bishop Pudsey had a survey of the extensive and various estates of his See in the county of Durham. From entries in this survey, it appears that the early Bishops were mighty hunters, their tenants often holding lands by the service of protecting the deer and furnishing horses, greyhounds, and other dogs for the chase. In ancient charters conveying licences to enclose certain forest-lands the *roe-deer* is sometimes mentioned amongst other animals which were enclosed or hunted. In the reign of Edward III. *roe-deer* were plentiful in the ancient forest of Pickering, North Riding of York. In the year 1340 a prosecution of the Crown was instituted against Henry de Percy, Lord of the Manor of Semere, for allowing his woodward to carry a bow and arrows and "chase and take roe-deer within the limit of this forest." The defendant pleaded successfully that the *roe* was a beast of warren, and not of the forest, and established thereby a right of free warren contrary to the opinion of many old English writers on venery, who included the *roe* among the beasts of chase, and consequently claimed to come under the forest laws. Holinshed tells us that in Henry V.'s reign (1415-22) "The *stag* was accounted to be the most noble game; the *fallow-deer* is the next, and the *roe*, of which we have indifferent store." Leland, in his Itinerary, says "In Northumberland, as I hearsay, there be no forest, except *Chevit Hills*, and there is a great plenty of redde-dearre and riw-bukkes." Mr. Harting says "It is curious that Leland should have made this statement, for, besides Cheviot, there were in Northumberland, the forests of Rothbury, Redesdale, Eresden, Lowes, Allendale, and Knares-lake."

According to the report of the Royal Commissioners, furnished to Henry VIII., 1512, there were nearly 6,000 head of deer—

red, *fallow*, and *roe*—in the forests and parks of the Earl of Northumberland and in the northern counties. Scott, in his "British Field Sports" (1820), says "That the last of its race was killed in Northumberland about seventy years ago." Bewick, in his "History of British Quadrupeds," mentions the capture of a wild *roe* in Northumberland as early as the beginning of the nineteenth century. From the context it appears to have been brought there by the hounds from Scotland. After many escapes and adventures it was ultimately killed in Northumberland and never returned to Scotland. In my experience the roebuck does not usually return to its old haunts after being hunted, but remains where it was left by the hounds. This accounts for its wide distribution in this country.

The *roebuck* is unknown in Ireland, and, as its remains have never been found in the island, it may be inferred that it is not indigenous. There are, however, some conflicting records of it, unless the word "barbog" is wrongly rendered. Among the collection of the horns of Irish red-deer there is a small shed-horn, apparently of a *roebuck*, "No. 45," catalogued as having been presented by Joshua Ferguson, Esq. Of this horn our friend, Mr. Harting, says "If it is really the horn of a *roebuck* found in Ireland, its history is worth tracing." The Marquis Ivrea, whose exhaustive work on the roebuck is now in the Press, and who has studied the habits of the roe-deer far and wide, tells me that he made a special visit to Dublin to see and judge for himself. In spite of the assistance he received from Dr. Scharff, keeper of the Natural History collections, he was unable to find any trace of the horn. Dr. Scharff suggested out that, if "Barbog" is correctly rendered *roebuck*, then the list of Irish animals omits the *red-deer*, which is very unlikely. On such evidence we are justified in coming to the conclusion that the roebuck is not indigenous to Ireland. In a paper of the late Professor Leith Adams on "Recent and Extinct Irish Animals," published in the Proceedings of the Royal Dublin Society for 1878, he tells us that "Neither the *fallow* nor the

roe-deer, nor the *moose* (elk) have any valid claim to be considered Irish mammals."

Mr. Harting tells us that there were a good many *roe-deer* at Petworth, Sussex, and he was told by the owner, Lord Leconfield, that there is a tradition that they were introduced, and are not the descendants of an ancient manorial stock.

In the year 1800 Lord Dorchester turned out a few brace of *roe-deer* into the woods of Milton Abbey; Mr. Pleydell, the owner of the adjoining woods of Whatcombe, aided him in their preservation. In a few years the woods were sufficiently stocked to induce Mr. Pleydell to hunt them with his harriers. The first was killed on November 6th, 1815; from that date to November 9th, 1818, the pack hunted the *roebuck* and the *hare* indiscriminately, but in the following year the *roebuck* exclusively, until the year 1829. The last entry in his Hunting Journal was dated January 16th of that year: "The hounds killed a *roebuck* after a run of 65 minutes." Mr. Pleydell sent up two brace of *roebucks* to Windsor at the wish of George IV., which were turned out in the Royal Park. There is no record how they fared in the Royal demesne.

In the Sporting Magazine for the year 1824 there is a letter from a correspondent dated May 2nd, 1824, at the Cardinal's Cap, Milborne St. Andrew:—"I slept here on my way from Devonshire, after hunting with the Devon Staghounds, purposely to see the Dorsetshire Roe-buck Hounds. The kennel is spacious and extremely well built. The huntsman, William Rice, who had lived all his life in the Pleydell family and had hunted the harriers in Mr. Pleydell's father's time, the hounds having been kept in the family for more than a century. The pack consisted of eighteen couple of dwarf foxhounds and a few moderate-sized harriers. With one or two exceptions, a prettier pack I have never seen. They finished the season in the second week of April, having killed fourteen brace of *deer*. In the middle of the season they killed six times following, each producing a good run, from three to three hours and a-half. The covers are drawn in the same manner as for a

fox. At first the roebuck runs short and does not care to keep very far from the hounds, and will allow itself to be surrounded by them; but, when once it takes the open, it will run for more than two hours before it is taken. It is remarkable that foxes and hares are occasionally chopped, but the roebuck scarcely ever, their agility and strength enabling them to evade the hounds. None, not even the oldest buck, has been known to stand at bay, but will allow itself to be taken without an attempt to defend itself, owing probably to the absence of a brow antler."

Mr. Somerville, in his poem, "The Chase," gives a graphic and exciting description of hunting the roebuck:—

> Heaven taught the roebuck swift—
> Loiters at ease before the driving pack
> And mocks their vain pursuit; not far he flies,
> But checks his ardour, till the steaming scent
> That freshens on the blade provokes their rage.
> Urged to their speed, the weak deluded foes
> Soon flag fatigued; strained to excess each nerve,
> Each slackened sinew fails; they pant, they foam.
> Then o'er the lawn he bounds, o'er the high hills
> Stretches secure, and leaves the scattered crowd
> To puzzle in the distant vale beneath.

Mr. Pleydell handed his pack over to Mr. Drax, who soon after transformed it into a pack of foxhounds, which he continued until the year 1843. From that date the *roebuck* was hunted casually by harriers, notably by the Rev. Harry Farr Yeatman's, who was a veteran sportsman, and for many years Chairman of the Quarter Sessions for this county. His pack had many a record of runs after an "adamantine" hare, as he termed it. Another pack, the Mountain Harriers, of which Mr. James Harding, of Waterson, was the appointed master, appears to have hunted the roebuck more regularly. On March 19th, 1838, they appear to have had rather a promiscuous, or, in modern ecclesiastical language, a comprehensive day's sport, to wit, a *fox*, a *roebuck*, and two *hares*. We have to thank the late Mr. Henry Symonds for his diary of "Runs and Sporting Notes from Dorsetshire, 1899," of which he had been witness, edited by his son.

The last record Mr. Symonds gives of this pack is December, 1838, when they met at Bulbarrow with twelve and a half couples of harriers. Accounts of several runs with Mr. Radclyffe's harriers between March 25th, 1856, and April 3rd, 1857, are given by Mr. Symonds. After this date Mr. Radclyffe became the Master of the South Dorset Hounds.

The *roebuck* can be most favourably observed when feeding on the rides of the woods, or browsing among the low underwood in the mornings and evenings before dawn until the sun has risen above the horizon, and towards sunset. It may then be seen stripping the brambles, hazel, ash, or rose-bushes, leaf by leaf. It is ever watchful, and upon the slightest noise, to which it is unaccustomed, it will immediately disappear, and if thoroughly alarmed it will be seen with marvellous agility appearing above the standing underwood and disappearing again several times. During the daytime the little herd repose among the thicket and bushes, under the vigilant eye and ear of the old *buck*, who, on giving the alarm-signal, sends the whole family to flight. It is very cautious in its movements, especially among fallen sticks and dead leaves, and may be seen extending the fore and hind-legs one by one to avoid attracting notice.

The fawning time is in the months of April and May, when the doe separates herself and retires in the most secluded parts of the wood and remains there until the birth of her fawn or fawns, which are sometimes three in number, and, like the young of all the Cervidæ, are at first spotted or speckled with white. It is not long before they are able to take care of themselves, and in the course of a fortnight they are as active as the parent mother.

The proverbial affection of the mother for her young is very strong in the case of the *roe*; although feeble and timid by nature, she will show much courage when menaced with danger, and will attack the intruder. She has been seen to encounter a *fox* and rout it with her fore-legs alone. Mr. Harting gives the following graphic description of the lair of the roe, in the 13th volume of the Zoologist, page 85 :—" In the middle of a thicket there was a group of young trees, growing out of a carpet of deep moss,

which yielded like a pillow of down. The prints of the doe's slender forked feet were thickly tracked about the hollow, and in the centre there was a bed of velvet 'fog,' which seemed a little higher than the rest, but so natural that it would not have been noticed by an unaccustomed eye. I carefully lifted up the velvet cushion, and under its veil, rolled close together, the head of each resting on the flank of the other, nestled two beautiful little *kids*, their large velvet ears laid smooth on their dappled necks, their spotted sides sleek, and shining as satin, and their little delicate legs as slender as hazel-wands, shod with glossy shoes as smooth and black as ebony, while their dark eyes looked at me out of their corners with a full mild and quiet gaze which had not yet learnt to fear the hand of man." Turberville, who wrote his "Book on Hunting" three centuries ago, says:—"During the first year of the buck it is termed a *kid*, the second year a *gyrle*, the third a *hemule*, the fourth a *roebuck* of the first head, and the fifth a *gart roebuck*. When several are seen together, they are spoken of as a *bevy* of roes. The season for hunting them is between Easter and Michaelmas for *bucks*, and for *does* between Michaelmas and Candlemas. A *hart* is harboured, a *buck* lodged, and a *roe* bedded, when among the fern and underwood. The voices of the three can be distinguished thus:—The *red-deer* belleth, the *fallow-buck* groaneth, and the *roebuck* belloweth. In May the roes change their brown-russet coat for bright red, as well as the white shield below, which reappears in August, when the coat has resumed its normal colour. When the roes are moving about quietly and undisturbed, their shields are not very conspicuous, but, when alarmed or excited, they appear to have the power of expansion, attributable probably to the muscular action of the skin, analogous to that of the *peacock*, by which it can erect and spread its mass of tail-plumage disc-like, or to that of the *dog*, which can erect its bristles in anger or defiance.

The gestation of the *red* and *fallow-deer* is eight months, that of the *roe* nine months. The impregnated ovum appears to be dormant for about three months, when development commences,

and the fawn is born about the middle of May. The horns of all *Cervidæ* consist entirely of bone; they spring from the frontal part of the skull, and during the whole period of growth they are covered with a hairy integument, technically termed velvet, which, when the horn is fully developed, loses its vascularity, dries up, and the velvet is stripped off, leaving the horn a strong and hard weapon. The *fallow-deer* shed their horns in May, and their restoration is completed in August. They retain the velvet until the end of October, when furious combats commence for the mastery, and submission to the victor. The horn-shedding is annual; the Cervidæ is the only family of the ungulates which has this peculiarity. With the exception of the *reindeer*, this frontal-appendage is confined to the male. The only hollow-horned ruminant is the *Prongbuck* (antelope). The horns of the *roe* are supported upon a stout bony pedicle on the skull. Their average length is nine inches, rarely ten. Each horn has three tines, of which the frontal springs from the anterior surface of its upper-half and with an upward direction. There is no brow-tine as with most of the family, following the ancestral type, as represented in the present day by the living *Muntjac*. The height of the buck averages thirty inches. Like *sheep*, the *roebuck*, before getting on its legs, rises from the ground on its knees.

The ulna and radius of the *roe* are anchylosed, and constitute that part of the fore-leg which is above the knee or carpal-bones. Of the five succeeding metacarpals, the third only is functional, the second is anchylosed to it at its distal end, affording probably an extra elasticity to the leg and neutralising the effects of concussion when the animal is in rapid movement. The metatarsal and metacarpal shank-bones have a deep longitudinal groove or furrow for the reception of a muscle which affords it the remarkable bounding power which the *roe* so eminently possesses. The *St. Kilda sheep*, which are equally agile, have a similar groove in their metacarpals and metatarsals.

The Family *Cervidæ* belong to the sub-order Artiodactyla, one of the four groups of the Ungulata, herbivorous mammals with

hoofs, the axis of both feet passing between the third and fourth digits, which are equally developed. In tracing the many changes through which the Artiodactyla have passed, from the Upper Eocene to the present day, both in Europe and North America, they vary from four or five complete digits in each foot to one pair, as in the case of Deer; two of the metacarpals are fused together into one cannon-bone, the ulna is reduced and fuses with the radius. The fore-leg of a horse below the knee is made up of three bones, the great metacarpal or cannon bone and two smaller deteriorated metacarpals which are attached to it at the proximal end. This attachment confers elasticity to the fore-leg and is useful in diminishing the concussion, but affords it less strength than an absolute union of the metacarpals. The *roe*, *elk*, *chevrotine*, and some others, on the other hand, have one splint-bone, which is placed at the distal end. This reversal from the proximal to the distal-end of the bone is possibly a provision to lessen the concussion consequent on the bounds and jumps of the *roe*, or to the floundering of the *elk* in the snow-drifts, or the woods and forests of their northern homes.

The *roe-deer* are infested with a parasite, *Lipoptena cervi*, Fam. Hippoboscidæ, related to the well-known Forest-fly, which is common on our heath-lands. Like the Forest-fly in the early days of its imago state, it is furnished with a pair of wings, which it only makes use of to settle on its cervine host; owing to their loose attachment to the body of the insect, they are easily brushed off as it pushes itself through the fur, preparatory to taking up its permanent abode in the warm flanks of the deer. I made several unsuccessful attempts to keep them alive for reproduction, and the examination of their habits and modes of life, but I signally failed on account of their dependence upon living blood, which I was unable to provide them with. None survived their third day's captivity. *Lipoptena cervi* was little known to British entomologists in 1898. There was only one solitary specimen in the British Museum, which had been taken (if I recollect right) from a *stag* and was in a very dilapidated condition. The Whatcombe specimens may now be seen in the

entomological collections of the British Museum in both the winged and apterous state.

Palæontological.

During the tertiary period there is no undisputed evidence of man on the scene, though some are of a different opinion; it was only at the commencement of the Quaternary period that the evidence is without doubt. It is characterised by a fauna of land animals, consisting of extinct and living species, in fact a transition between the past and the present. In studying that portion of the British Quaternary fauna within our regions we find representatives of warm climates, such as the *hippopotamus*, which lives habitually in the lakes and rivers which are never frozen over, and the *African elephant*. On the other hand we find numerous species peculiar to high latitudes, such as the *rein-deer*, the *musk-ox*, the *glutton*, the *saiga*, and *mammoth*. There is every reason to conclude that during this period there were alternate seasons, a cold one and a warm one, the former preceding the latter.

In England and Wales the caves were at first the dens of wild beasts, and only occasionally visited by palæolithic man, but afterwards they became more frequently his sole abode, and the remains of the wild animals found in them were without doubt introduced by him. In the Quaternary beds we find two elephants, *Elephas antiquus*, a species intermediate between the living African elephant and the Asiatic elephant, but nearer to the latter, adapted to live in warm latitudes; and the *E. primigenius*, or mammoth, which was covered with a thick coat of fur, and adapted for a severely cold climate.

M. Mortillet considered that the caves might be classed according to their relative order. 1. Magdalenian, Palæolithic age. Bones sculptured and engraved; the fauna boreal. 2. Solutrean. The climate of this period was comparatively dry and without much rain; the fauna combining the boreal with temperate types—*Mammoth*, *Reindeer*, *Ursus arctos*, *Glutton*, *Rhinoceros tichorhinus*, *Horse* (two species), *Bison*, *Chamois*, *Saiga Antelope*,

Roe-deer, and *Fallow-deer*. The lower beds of Cresswell cave belong to this epoch, as do the Mentone caves. 3. The Mousterian epoch is characterised by the Engis Skull. This, too, had a mixed climatic fauna, the *Musk Ox*, the *Mammoth*, the *Cave Lion*, the *Hyæna*, the *Irish Elk*. Kent's cave (in part), and Wookey Hole contained representatives of this group. 4. The Chellean group. Several elephants belong to this group. *Elephas antiquus* occurs in the lowest beds of this group and was succeeded by its nearly allied species, *E. meridionalis*, whose remains were found at Dewlish, and described in a volume of the Proceedings. *E. antiquus* is common in Italy and Sicily; it has also been found in Piedmont and the Val d'Arno. It has been found in the Forest-bed of Norfolk, with four species of *rhinoceros*, the *hippopotamus*, and the *sword-toothed tiger*, which appeared then for the first time, also the *roe-deer*, which is often associated with *Elephas antiquus*, and found in the bone-caves of Poland with that *elephant*. The *roe-deer* has been found in the Cave-fauna of England and Wales, at Bleadon, Somerset, Spritsail, Tor Gower. It occurs also in the Belgian caves, at Aurignac, the Dutch kitchen middens and lake dwellings. There is no corroborative evidence of the *roe-deer* in the forest bed, of Norfolk. The reputed occurrence of it there in the King Collection (Jermyn Street Mus.) is derived from a specimen of doubtful origin, which is believed to be post-glacial. It has been recorded from caves and other Quaternary deposits (Quart. Journ. Geol. Society, Vol. xxv., p. 192, 1869), as well as from the fens and prehistoric beds. The term post-glacial is used as the exact equivalent of the Quaternary of Mr. Prestwich, and is applied to that group of animals which have been proved to have inhabited France, Germany, and Britain after the glacial period, and which arrived at that portion of the pre-glacial continent which was not submerged during the great boulder-drift period, when the melting icebergs floated over the depressed area in Northern Europe. The change of climate must have banished to a great extent the pre-glacial mammals from Europe. The Arctic post-glacial

mammalia (the *mammoth* and *tichorhine rhinoceros*), for instance, migrated into Europe from the ancient homes in the north of Asia, where they probably dwelt during the Pliocene period. The climate of the post-glacial period was continental in character before Britain was separated, and when the extreme cold of winter and the extreme heat of summer were more pronounced. The presence of the *rein-deer*, the *musk-ox*, &c., implies that the climate was Arctic. On the other hand, the *hippopotamus major*, so far as we can judge from the habits of the living species, could not have endured the low temperature adapted for the *musk-ox* and the *reindeer*, and involves the necessity of supposing that the climate was comparatively warm. The *hippopotamus* might have been a summer visitant only, and migrated southwards in the winter to a more genial climate. From that time to the present day the climate gradually modified. At the close of the prehistoric epoch the sole survivors of the northern migrants were the *elk* and the *reindeer*, the latter became extinct in the mountains of Caithness towards the end of the twelfth century.

The only wild animal which is known to have invaded Europe in the historic age is the Norway rat (*Mus decumanus*), which passed from Asiatic Southern Russia in the year 1727 and arrived in Britain certainly before the year 1730, and has since nearly exterminated the black species, *Mus rattus*. The *fox*, the *badger*, and the *otter* were widely distributed, and the *wild cat*, which still lingers in Pembrokeshire and in the North Riding of Yorkshire. The *red-deer* and the *roebuck* were widely distributed in the prehistoric period.

The Roman-Celtic short-horned, deer-like *Bos longifrons* has been found without exception in every examined refuse-heap accumulated in Great Britain during the Roman age. It has been found associated with the *roebuck* at Bath, Maidstone, London, and Honiton, also in the Romano-British villages, in the neighbourhood of Rushmore, which the late General Pitt-Rivers so thoroughly examined. Besides the records of the occurrence of the *roebuck* during the Roman occupation there are

several others which testify to its occurrence in Britain at the time of the Norman Conquest.

The Cervidæ living at this present day are found in almost the whole of the northern hemisphere, Central India, Central and South America. Their fossil remains occur in the same regions, and are very abundant in Europe and South America, and are absolutely absent in Central and South Africa. With few exceptions these fossil remains can be classified in groups (genera and species) with those now living. These are divided into the Plesiometacarpalia (*Cervus* and *Cervulus*), which mainly inhabit the Old World, characterised by the retention of the proximal lateral metacarpals, and the Telemetacarpalia (*Capreolus*, *Alces*, *Rangifer*, and *Cerviacus*), characterised by the retention of the distal lateral metacarpals. The most striking feature is the presence of horns, for not only are they absent on the skulls of the females, with the exception of the *rein-deer*, but also on those of both sexes in their most ancient fossil forms. One advantage of the antlers is that the species can be distinguished by them. In the case of those, which have many tines, it commences with a single point the first year, bifurcates the second year, and so on each succeeding year, until their bearer attains the age of a perfect buck.

In most ancient forms, *Amphitraglus* and *Palæomeryx*, Miocene, the antlers are absent, except in *P. furcatus* of the French Middle Miocene, which had simple antlers and small canines. *P. Bojani*, also of the French Middle Miocene, and *P. sivalensis*, of the Pliocene of India, were as large as a *red-deer* of the Elaphine group, which includes the Canadian *Wapiti* (Cervus canadensis), and the *red deer* (C. elaphus) of Europe and North Africa. Some of the jaws and antlers of this group, from the Pleistocene of Europe indicate much larger animals than any *red deer* now existing, and it has been suggested that their remains belong either to *Cervus maral* of Persia, or to the *Wapiti* (*C. canadensis*) of North America. Remains of the *Wapiti* are recorded from the Pleistocene of the United States. To another group belongs *C. Sedgwicki* of the Norfolk forest-

bed and the Upper Pliocene of Italy, in which the antlers are more complex than in any other species. *Fallow-deer* occur in the bone caves of Gibraltar, allied forms of which are found in the English forest-bed and Crag, of which the most remarkable is *C. verticornis*, in which the brow-tine is bent sharply downwards. The group Megacerotine, which contains only the Irish deer, *Cervus giganteus*, characterised by its enormous palmated antlers, has a distinct brow- and bez-tine, and a small posterior tine on the opposite side of the beam to the bez-tine. Their remains are found in the Pleistocene of Northern Europe and are abundant in the bogs of Ireland of this age. The *rein-deer* which is now confined to the higher latitudes of the Northern hemisphere, was abundant in the Pleistocene of a large portion of Europe.

The first antler-bearing deer which appears in the geological record is *Dicroceros elegans*, Lartet, Middle Eocene, Dep. Gers, France, and belongs to the Capreoli group. The antlers consist of a single fork, springing from the beam close to the burr, similar to those of the *Cervulus muntjac*, which are placed on a long and slender pedicle. *Cervus Matheroni*, Gervais, from the Upper Miocene of Pikarmi, Greece, and Mont Lebéron, Dep. Vaucluse, France; and *C. cusanus* from the Pliocene strata of Arde, Le-Puy, Dep. Haute Loire, France, which is regarded as the ancestor of our *roe-buck*. Both were probably similar in size; the antlers of the latter were longer and more slender, and the channelled beam free from knobs. It made its first appearance in the forest-bed of Norfolk, and through it the Capreoline type may be traced back to *Cervus Matheroni*, of the Upper Miocene.

We may gather from the study of the fossil Cervidæ the fact that in the Middle Miocene age the antler consisted of a simple forked-crown only. In the upper Miocene it becomes more complex, but still small and erect, like that of the *roe-buck*. In the Pliocene it became larger and longer, and altogether more complex and differentiated, some forms, such as *Cervus dicranios*, Nesti, and *C. Sedgwicki*, Falconer, from the Norfolk forest-

bed, bear the most complicated antlers known, either in the living or fossil state. These successive changes are analogous to those observed in the development of the antlers in the living deer, which begin with a simple point and increase in the number of tines until their full number is attained and the deer has reached the adult age. The Capreoline type is older than any other. With the exception of *Cervus cusanus*, which possessed an antler differing little from the *roe-buck*, and was widely spread over Europe and Northern and Central Asia, all the Pliocene deer which can be brought into relations with living forms are closely allied to the *Axes* and *Rusæ*, now restricted to the Oriental regions, and belong to a fauna met with only in the forests of India, China, Japan, and the Malay Archipelago. The presence in this part of the world of a group of animals met with only in warm regions, confirms the conclusions as to the warm climate of Pliocene Europe, which are also confirmed by the character of the vegetation of that age.

On New and Rare British Arachnida.

By Rev. O. PICKARD-CAMBRIDGE, M.A., F.R.S., &c.

(Read December 3rd, 1901.)

DURING the eighteen months that have passed since my last communication on spiders, I have not been able to do a great deal of outdoor work myself, but the efforts of several correspondents, who have most kindly placed the results of their collecting at my disposal, enable me to present a very satisfactory summary to our Field Club today. Nor has my own success been inconsiderable, whether in the direction of correcting synonyms, working out doubtful species, or finding new ones. In the following pages seven species of spiders are described as new to science and four others new to Britain. Of the species new to science an *Agroeca* and a *Wideria* were found by Mr. Cecil Warburton, of Cambridge; the former at Folkestone, the latter at Cambridge. Two others, a *Micronela* and an *Entelecara*, were taken near Glamorgan, in South Wales, by Dr. Randall Jackson, M.D., of Ton Pentre. The three remaining new species were discovered by myself, one (a *Lycosa*)

DESCRIPTION OF PLATE.

Fig. 1.—*Tmeticus affinis*, Bl. (female). 1*a*, genital aperture; 1*b*, eyes from above and behind.

,, 2.—*Micronecta cauta*, sp. n. (male). 2*a*, eyes, and fore extremity of caput from above and behind; 2*b*, right palpus from outer side (*a* curved process of palpal organs); 2*c* (female), genital aperture.

,, 3.—*Diplocephalus alpinus*, Cambr. (male). 3*a*, left palpus in front; 3*b*, profile of caput.

,, 4.—*Diplocephalus latifrons*, Cambr. (male). 4*a*, right palpus in front. (The process *b* in fig. 4*a* is a little too long.) 4*b*, profile of caput.

,, 5.—*Tapinocyba Parisiensis*, Sim. (female), 5*a*, eyes from above and behind; 5*b*, left palpus on outer side; 5*c*, right palpus from inner side; 5*d*, ditto from above and behind; 5*e* (female), genital aperture.

,, 6.—*Entelecara Jacksonii*, sp. n. (male), 6*a*, eyes and cephalothorax from above and behind; 6*b*, ditto in another position; 6*e*, left palpus on outer side; 6*d*, ditto on inner side; 6*c*, sternum and labium; 6*f*, profile of spiders without legs and palpi; 6*g* (female), genital aperture.

,, 7.—*Evansia merens*, Cambr. (female). Genital aperture.

,, 8.—*Wideria Warburtonii*, sp. n. (male). 8*a*, eyes from above and behind; 8*b*, profile of cephalothorax; 8*c*, right palpus on outer side; 8*d*, radial joint of ditto, from outer side above and behind.

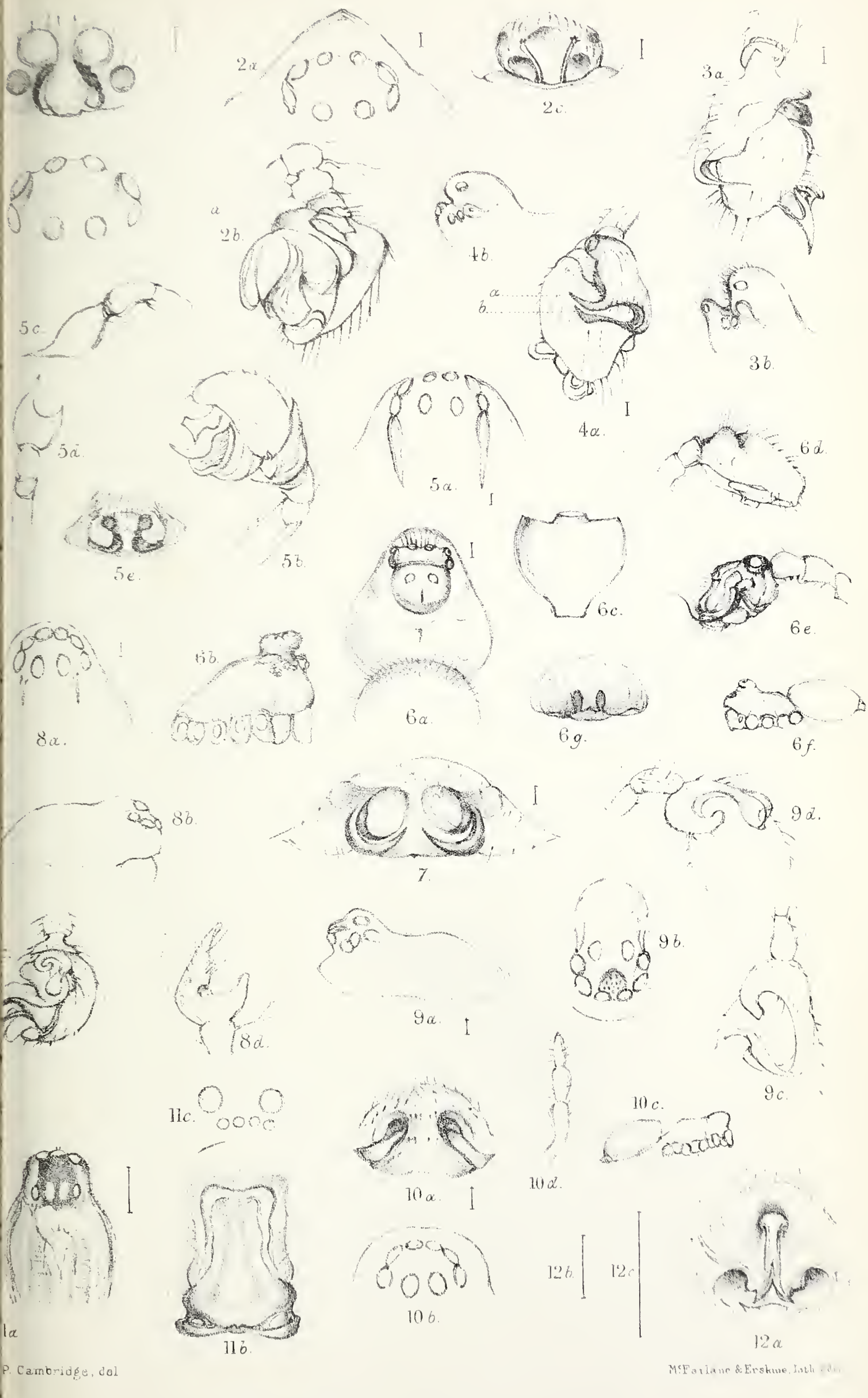
,, 9.—*Wideria incerta*, sp. n. (male). 9*a*, profile of cephalothorax; 9*b*, eyes and fore part of caput from above and in front; 9*c*, right palpus in front; 9*d*, ditto on outer side.

,, 10.—*Wideria subita*, sp. n. (female). 10*a*, genital aperture; 10*b*, eyes from above and behind; 10*c*, profile of abdomen and cephalothorax; 10*d*, left palpus, upper side.

,, 11.—*Lycosa promptula*, sp. n. (female). 11*a*, cephalothorax on upper side; 11*b*, genital aperture; 11*c*, eyes of first and second rows in front.

,, 12.—*Lycosa paludicola*, Clerck-Cambr. (female). 12*a*, genital aperture; 12*b*, natural length of spider; 12*c*, length of leg of 4th pair.

N.B.—The short lines in the plate indicate the natural lengths of the spiders to which the dissections belong.



P. Cambridge, del. McFarlane & Erskine, Lith. Edin.

NEW AND RARE BRITISH SPIDERS.

at Swanage, a *Wideria* at Bloxworth, and another of the same genus on Ralsbury Camp, near Bulbarrow. Of the four species now recorded as new to Britain, one (*Styloctetor inuncans*, *Sim.*), was found by Dr. Jackson near Glamorgan, another (*Tapinocyba Parisiensis*, Sim.), by Mr. Frank P. Smith at Sevenoaks, Kent, a third (*Cornicularia Karpinskii*, Cambr.), in Scotland by Mr. William Evans, of Edinburgh, as well as by Dr. Jackson in Cumberland, and the fourth (*Lycosa paludicola*, C. L. Koch), in Parkhurst Forest, Isle of Wight, by the Rev. J. E. Hull, of Haltwhistle, Cumberland. Many others of the spiders in the subjoined list are noteworthy either from their rarity or from some other circumstance, but I will only in this short preface remark upon one of them; I allude to an example of *Hilaira excisa*, Cambr., which is a so-called *Hermaphrodite!* This phenomenon is well known among the *Insecta*, but I am not aware that it has ever before been recorded among spiders. This example of *Hilaira excisa* has one of the palpi of the male form, the other of the female, the caput bearing the peculiar structure belonging to the male alone, and the abdomen being also of the normal male form. I once found a somewhat similar specimen in a collection of exotic spiders, but it was lost or destroyed by some mishap before I could either make a drawing or description of it.

ORDER ARANEIDEA.

Gen. Drassus, Walck.

Drassus minusculus, L. Koch-Cambr. List of British and Irish Spiders, 1900, p. 7.

An adult female on the gravel walk in the Bloxworth Rectory flower garden; it had only occurred previously, in this district, at a considerable distance, under stones and among heather in damp spots on Bloxworth Heath.

Gen. Prosthesima, L. Koch.

Prosthesima latitans, L. Koch-Cambr. List Brit. and Ir. Spid., p. 8.

An adult female taken by A. W. Pickard-Cambridge near Lulworth Cove, September 10th, 1900. The first recorded occurrence of this sex in England.

Prosthesima lutetiana, L. Koch-Cambr. List Brit. and Ir. Spid., p. 74.

Adult females received from Mr. W. Evans, by whom they were found at Reaton, Loch Long, Scotland, in 1900.

Prosthesima electa, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 8.

An adult of each sex found by Mr. W. Evans on Largo Links, Scotland, June, 1900; also an adult of each sex at Southport, Lancashire, by Mr. C. Warburton.

Gen. Agroeca, Westr.

Agroeca proxima, Cambr. List Brit. and Ir. Spid., p. 13.

Both sexes received from South Wales, where they were found by Dr. A. Randall Jackson in 1901.

Agroeca inopina, Cambr. List Brit. and Ir. Spid., p. 13.

Both sexes found near Glamorgan, South Wales, and received from Dr. A. Randall Jackson in 1901. These examples are rather larger, darker, and more distinctly marked than those I have met with in Dorsetshire.

Agroeca notata, sp. n. (for description see postea p. 30).

Adults of both sexes were found at Folkestone by Mr. Cecil Warburton among herbage in 1901. It appeared to be by no means rare.

Agroeca celer, Cambr. List Brit. and Ir. Spid., p. 13.

An immature male, found in an ant's nest at Portland in April, 1901, by Mr. H. Donisthorpe.

Gen. Protadia, Sim.

Protadia patula, Sim.

Dictyna patula, Sim.-Cambr. List Brit. and Ir. Spid., p. 14; inadvertently retained l.c. as a *Dictyna*.

Protadia subnigra, Cambr. List Brit. and Ir. Spid., p. 15.

Adult females on iron railings at Bloxworth Rectory in May, 1901. Its first occurrence in this district, and the situation

unusual. Adult males from the Isle of Wight, found by Rev. J. E. Hull.

Gen. Cryphoeca, Thor.

Cryphoeca diversa, Cambr. List Brit. and Ir. Spid., p. 16.

An immature female received from Mr. H. Donisthorpe, by whom it was found in a nest of *Lasius fuliginosus* in June, 1901, at Oxshott, Surrey. An immature male had been previously found by Mr. Donisthorpe in a similar situation in the same locality (see Proc. Dors. F. Club, Vol. xxi., p. 10.)

Gen. Tegenaria, Latr.

Tegenaria silvestris, C. L. Koch.

„ *campestris*, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 17.

Typical examples received from Prof. L. Kulczynski have convinced me that the British spider hitherto considered to be *T. campestris*, C. L. Koch, is the *Tegenaria silvestris*, C. L. Koch. The former, therefore, has not yet occurred in Great Britain, though it is nearly allied to the latter, but easily distinguishable.

Tegenaria Derhamii, Scop.

„ *pagana*, C. L. Koch.-Cambr. List Brit. and Ir. Spid., p. 17.

From types of *T. pagana*, C. L. Koch, lately sent to me by Prof. L. Kulczynski, the spider I had thought to be of that species appears to be only a variety of *T. Derhamii*, Scop. *T. pagana* must therefore be expunged from the British List.

Gen. Cicurina, Menge.

Cicurina cinerea, Panz-Cambr. List Brit. and Ir. Spid., p. 17.

An immature female found in a nest of *Lasius fuliginosus* at Oxshott by Mr. H. Donisthorpe in the spring of 1901.

Gen. Hahnia, C. L. Koch.

Hahnia helveola, Sim.-Cambr. List Brit. and Ir. Spid., p. 18.

An adult male received from Mr. W. Evans in 1901, found in Lanarkshire. Not before recorded in Scotland.

Gen. Theridion, Walck.

Theridion familiare, Cambr. List Brit. and Ir. Spid., p. 20.

This pretty little species was rather abundant in July, 1901, in the angles of windows and doorways of out-houses at Bloxworth Rectory, both sexes adult and immature. In some seasons it is very scarce.

Gen. Euryopis, Menge.

Euryopis flavomaculata, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 23.

An adult male found at Loch Rannoch, Scotland, by Mr. H. Donisthorpe in 1901.

Gen. Laseola, Sim.

Laseola inornata, Cambr. List Brit. and Ir. Spid., p. 23.

An adult male found by Mr. F. P. Smith at Loughton, Essex, in 1901.

Gen. Linyphia, Latr. (*ad partem*).

Linyphia furtiva, Cambr. List Brit. and Ir. Spid., p. 27.

For the first time for some years past I found adult females among heather on Bloxworth Heath, June 19th, 1900.

Gen. Leptyphantes, Menge.

Leptyphantes Mengii, Kulcz.-Cambr. List Brit. and Ir. Spid., p. 29.

An adult male found at Haltwhistle, near Carlisle, by the Rev. J. E. Hull.

Leptyphantes tenebricola, Wid.-Cambr. List Brit. and Ir. Spid., p. 29.

An adult of each sex received from Mr. W. Evans, by whom they were found at Penicuick, Scotland, in 1901.

Gen. Porrhomma, Sim.

Porrhomma inerrans, Cambr. List Brit. and Ir. Spid., p. 31.

Received from Mr. F. P. Smith, by whom it was found at St. Leonard's, Sussex, in May, 1900.

Porrhomma oblongum, Cambr. List Brit. and Ir. Spid., p. 31.

Adults of both sexes among grass and other herbage at Bloxworth in June, 1900.

Porrhomma egeria, Sim.-Cambr. List Brit. and Ir. Spid., p. 31.

An adult female received from the Rev. J. E. Hull, by whom it was found in the Isle of Wight.

Gen. HILAIRA, Sim.

Hilaira excisa, Cambr. List Brit. and Ir. Spid., p. 32.

Adults of both sexes found near Glamorgan and sent to me by Dr. A. R. Jackson in 1901. Among them was a remarkable bi-sexual form. One of the palpi was that of the male spider, the other that of the female; the form of the caput was that of the male, and the abdomen was of the male form. I have seen a somewhat similar form in an exotic spider, but never before among the many thousands of British spiders I have had occasion to examine.

Gen. TMETICUS, Menge.

Tmeticus affinis, Bl.-Cambr. List Brit. and Ir. Spid, p. 34. (Fig. 1.)

An adult female was found in Lingay Fen, Cambridgeshire, by Mr. Nigel Pearce and sent to me by Mr. Cecil Warburton in 1900.

Tmeticus arcanus, Cambr. List Brit. and Ir. Spid., p. 34.

An adult male from near Glamorgan found by Dr. A. R. Jackson in 1901.

Tmeticus Hardii, Bl.-Cambr. List Brit. and Ir. Spid, p. 33.

An adult male sent to me by Mr. William Evans from Elvanfoot and Leadhills, Scotland, in 1900.

Tmeticus montigena, L. Koch-Cambr. List B. and Ir. Spid., p. 33.

Adult males and an adult female from Lanarkshire in October, 1900, found by Mr. W. Evans.

Gen. MICRONETA, Menge.

Microneta conigera, Cambr. List Brit. and Ir. Spid., p. 35.

Adult males found at Southport, Lancashire, by Mr. C. Warburton in 1900, and females from Dr. A. R. Jackson near Glamorgan in 1901.

Microneta cauta, sp. n.

(Fig. 2. For description see p. 31.)

Adults of both sexes, allied to *M. conigera*, Cambr., found near Glamorgan in 1901 by Dr. A. R. Jackson.

Microneta sublimis, Cambr. List Brit. and Ir. Spid., p. 36.

Adults of both sexes received from Mr. W. Evans, by whom they were found at Elvan-foot and Lead Hills, Scotland, in 1900.

Microneta saxatilis, Bl.-Cambr. List Brit. and Ir. Spid, p. 36.

Numerous examples of both sexes received from Dr. A. R. Jackson, found in 1901 near Glamorgan.

Gen. SINTULA, Sim.

Sintula fausta, Cambr. List Brit. and Ir. Spid., p. 37.

An adult male found by Dr. A. R. Jackson near Glamorgan in 1901. This is the second record only of the species.

Gen. SUSARION, Cambr.

Susarion neglectum, Cambr. List Brit. and Ir. Spid., p. 38.

Adult females were received from near Huddersfield, where they were found and kindly sent to me by Mr. W. Falconer, in September, 1901.

Gen. GONGYLIDIUM, Menge.

Gongylidium tuberosum, Bl.-Cambr. List Brit. and Ir. Spid., p. 38.

Numerous examples were received from Dr. A. R. Jackson, by whom they were found in 1901 near Glamorgan.

Gongylidium gibbosum, Bl.-Cambr. List Brit. and Ir. Spid., p. 38.

Found abundantly in company with *G. tuberosum*, Bl. Numbers of females were found at the same time and locality, but no reliable difference for the determination of the species could be detected, though it is most probable that both

G. tuberosum and *G. gibbosum* were represented. The difference between the males of these two species is very striking and both are generally abundant in the same locality, but I have never yet been able to determine satisfactorily two distinct female forms separable by good tangible characters. M. Simon describes the genital aperture of each, and if the characters he gives are constant, then, the female of either one or the other of the two species has not yet come before me; certainly I have not seen the two forms of genital aperture described by M. Simon in his Araneides de France, Vol. V. According to his description I should determine all the females I have yet seen to be those of *G. gibbosum*.

Gongylidium agreste, Bl.-Cambr. List Brit. and Ir. Spid., p. 38.

An adult male on a wall, Bloxworth Rectory, July 20th, 1900.

Gen. GONGYLIDIELLUM, Sim.

Gongylidiellum vivum, Cambr. List Brit. and Ir. Spid., p. 39.

An adult male received from Mr. F. P. Smith, by whom it was found in June, 1901, at Loughton, in Essex.

Gen. ERIGONE, Sav.

Erigone pascalis, Cambr. List Brit. and Ir. Spid., p. 40.

Male and females received from the Isle of Arran.

Gen. TYPHOCRESTUS, Sim.

Typhocrestus dorsuosus, Cambr. List Brit. and Ir. Spid., p. 41.

Adults of both sexes found by Dr. A. R. Jackson at Southport, Lancashire, in 1900.

Gen. DIPLOCEPHALUS, Bertkau.

Diplocephalus latifrons, Cambr. List Brit. and Ir. Spid., p. 42.

,, *alpinus*, Cambr., l.cit. non *Walckenäera alpina*, Cambr., P.Z.S., 1872, p. 767.

(Figs. 3 and 4.)

The reception of numerous examples of *D. latifrons*, Camb., from S. Wales, found by Dr. A. R. Jackson, and others from other

English localities, led me to examine them afresh under the microscope and to compare them carefully with the types of this species, as well as with that of an allied species (*D. alpinus*, Cambr.). The result is that there is no doubt but that examples received from Scotland (see Proc. Dors. F. Club, Vol. XIV., p. 158, 1893, and Vol. XXI., p. 23, 1900), and believed to be *D. alpinus*, are, on the contrary, *D. latifrons*. Consequently *D. alpinus* must be expunged from the British List. The two species are closely allied, but the structure of the palpi (see figs. 3 and 4), with other differences, will serve to separate them without much difficulty. I have never seen the female of *D. alpinus*, but if the figure of the genital aperture given by M. Simon be correct (Ar. de Fr., Vol. V., p. 762, fig. 659) it will probably not be easy to distinguish that sex of the two species one from the other.

Gen. ENTELECARA, Sim.

Entelecara flavipes, Bl.-Cambr. List Brit. and Ir. Spid. p. 43.

Adults of both sexes beat from underwood, Bloxworth, on June 20th, 1900. This minute spider still continues to be a rarity, though more frequent in its occurrence in some seasons than in others.

Entelecara omissa, Cambr. List Brit. and Ir. Spid., p. 75. (For description see post., p. 33.)

Entelecara Jacksonii, sp. n.

(Fig. 6. See description post., p. 32.)

Adults of both sexes were found in 1901 near Glamorgan by Dr. A. R. Jackson. It is a very distinct species, and it gives me great pleasure to connect it with the finder's name.

Gen. METOPOBACTRUS, Sim.

Metopobactrus prominulus, Cambr. List. Brit. and Ir. Spid., p. 45.

Both sexes (adult) were found by Dr. A. R. Jackson near Glamorgan in 1901. Previously it had only been met with many years ago on Bloxworth Heath, Dorset.

Gen. Styloctetor, Sim.

Styloctetor inuncans, Sim. Araneides de France tom v. p. 735.

Adult males and an adult female were found at Aberavon, near Glamorgan, in 1901, by Dr. A. R. Jackson. This has not been before recorded as British, and is a fine addition to our list of indigenous spiders.

Gen. Troxochrus, Sim.

Troxochrus cirrifrons, Cambr. List Brit. and Ir. Spid., p. 46.

Dr. Jackson has sent me examples of the male from Southport, where it was originally found by myself in 1859. I still believe it to be a good species, though M. Simon thinks it is a variety of *T. scabriculus*, Westr. (*T. aggeris*, Cambr.)

Gen. Cnephalocotes, Sim.

Cnephalocotes elegans, Cambr. List Brit. and Ir. Spid., p. 46.

An adult male found in Cumberland by Dr. A. R. Jackson in 1901, and another by Mr. William Falconer near Huddersfield in 1901.

Cnephalocotes pusillus, Menge-Cambr. List Brit. and Ir. Spid., p. 47.

Adults of both sexes found by Dr. A. R. Jackson, Southport, Lancashire, where it seems to occur rather freely.

Gen. Tapinocyba, Sim.

Tapinocyba pallens, Cambr. List. Brit. and Ir. Spid, p. 47.

An adult of each sex found in Staffordshire by Dr. A. R. Jackson and an adult male in Lancashire by Mr. William Evans.

Tapinocyba Parisiensis, Sim. (Araneides de France tom v., p. 784.)

(Fig. 5.)

An adult male received from Mr. F. P. Smith, by whom it was found June 16th, 1901, at Sevenoaks, Kent. This spider, which is nearly allied to *T. subitanea*, Cambr., is now recorded for the first time as British.

Tapinocyba subæqualis, Westr.-Cambr. List Brit. and Ir. Spid., p. 48.

An adult male found at Southport, Lancashire, by Dr. A. R. Jackson in 1901.

Gen. CALEDONIA, Cambr.

Caledonia Evansii, Cambr. List Brit. and Ir. Spid., p. 48.

Both sexes (adult) received from Mr. W. Evans in October, 1900, Elvan Foot and Leadhills, Scotland; and an adult male from near Huddersfield, where it was found by Mr. W. Falconer in 1901.

Gen. PANAMOMOPS, Sim.

Panamomops bicuspis, Cambr. List Brit. and Ir. Spid., p. 48.

An adult male received from Mr. Cecil Warburton, by whom it was found at Cambridge in 1901, and another found at Haltwhistle, Cumberland, by the Rev. J. E. Hull.

Gen. WIDERIA, Sim.

Wideria cucullata, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 49.

" *nequam*, Cambr., l.c.

I have ascertained beyond a doubt that *Wideria nequam*, Cambr., is the female of *W. cucullata*, C. L. Koch. The former, therefore, becomes a synonym of the latter.

Wideria Warburtonii, sp. n.

(Fig. 8. For description see p 34.)

An adult male of this very distinct species was found among dead leaves at Cambridge in the autumn of 1900, and kindly sent to me by Mr. Cecil Warburton, with whose name I have great pleasure in connecting it.

Wideria subita, sp. n.

(Fig. 10. For description see p. 36.)

An adult female, which I believe to be new to science, was found by myself among grass tufts on Ralsbury Camp, near Bulbarrow, Dorset, in September, 1900.

Wideria incerta, sp. n.

(Fig. 9. For description see p. 35.)

An adult male found at Bloxworth. It had only just completed its final moult, so that, although the palpi were fully developed in the form of the radial joint, the palpal organs had not completely assumed their full development. It appears to be a very distinct spider.

Gen. EVANSIA, Cambr.

Evansia merens, Cambr. List Brit. and Ir. Spid., p. 50.

(Fig. 7.)

Adults of both sexes found near Glamorgan by Dr. A. R. Jackson in 1901. The female is new to science; it resembles the male in colours and general characters. The genital aperture (fig. 7) is characteristic.

Gen. PROSOPOTHECA, Sim.

Prosopotheca monoceros, Wid.-Cambr. List Brit. and Ir. Spid., p. 50.

Adults of both sexes, Southport, Dr. A. R. Jackson.

Gen. CORNICULARIA, Menge.

Cornicularia Karpinskii, Cambr. (sub. *Erigone*). Proc. Zool. Soc., Lond., 1873, p. 447, pl. xxi., fig. 12.

An adult male of this fine and interesting addition to the British List was sent to me in October, 1900, from the Lowther Hills, Lanarkshire, by Mr. W. Evans. Subsequently I received an adult of each sex found in Cumberland by Dr. A. R. Jackson.

Cornicularia lucida, Cambr. List Brit. and Ir. Spid., p. 51.

An adult male swept among grass and other herbage at Bloxworth, on 18th June, 1900. This is only the second recorded occurrence of the species.

Gen. SINGA, C. L. Koch.

Singa albovittata, Sund.-Cambr. List Brit. and Ir. Spid., p. 55.

Adults of both sexes on Bloxworth Heath June 18th, 1900. Not rare among heather, to which it appears to be confined.

Singa sanguinea, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 55.

An adult female, Bloxworth Heath, June 19th, 1900. A rare spider.

Singa pygmæa, Sund.-Cambr. List Brit. and Ir. Spid., p. 55.

An adult female, Loughton, Essex (Mr. F. P. Smith).

Gen. Epeira, Walck.

Epeira alsine, Walck.-Cambr. List Brit. and Ir. Spid., p. 56.

Adult females near Glamorgan (Dr. A. R. Jackson). This species appears to be not uncommon in the above locality. It has often a lovely violet hue, which, however, soon disappears when preserved in spirit of wine. The adult male is not often met with.

Gen. Thomisus, Walck.

Thomisus onustus, Walck.-Cambr. List Brit. and Ir. Spid., p. 58.

An adult male (perfectly concealed by its resemblance in colour to the bloom) found in a thistle blossom on Bloxworth Heath on June 14th, 1900.

Gen. Oxyptila, Sim.

Oxyptila sanctuaria, Cambr. List Brit. and Ir. Spid., p. 62.

The adult male occurred frequently at Bloxworth Rectory in September and October, 1900; but in 1901 scarcely one was seen. I have never yet succeeded in finding more than one female.

Oxyptila simplex, Cambr. List Brit. and Ir. Spid., p. 62.

An adult of each sex received from Cambridge, found by Mr. Cecil Warburton.

Gen. Tarentula, Sund.

Tarentula fabrilis, C. L. Koch-Cambr. List Brit. and Ir. Spid., p. 67.

An adult female with its egg-sac in an excavated hole on Bloxworth Heath on June 18th, 1900.

Gen. Lycosa, Latr., *ad partem.*

Lycosa paludicola, C. L. Koch-Cambr.

(Fig. 12.)

An adult female of this spider was found in Parkhurst Forest, Isle of Wight, in the early summer of 1900 by the Rev. J. E. Hull. It is nearly allied to *Lycosa amentata*, Clerck., but the different form of the genital aperture distinguishes it at once. There are also other distinctions. This is its first record as a British spider.

Lycosa promptula, sp. n.

(Fig. 11 For description see p. 37.)

An adult female found by myself several years ago at Swanage, Dorset. Hoping to have since met with others of this, which appears to be a very distinct species, it has not until now been recorded and described.

Gen. Marpessa, C. L. Koch.

Marpessa pomatia, Walck.-Cambr. List Brit. and Ir. Spid., p. 71.

An adult female found in Wicken Fen, Cambridgeshire, by Mr. H. Donisthorpe, September, 1900.

Gen. Hyctia, Sim.

Hyctia Nivoyi, Luc.-Cambr. List Brit. and Ir. Spid., p. 71.

Found among herbage on the cliffs at Folkestone by Mr. Cecil Warburton in 1901, and numerous examples of both sexes adult found near Glamorgan by Dr. A. R. Jackson in the same year. Hitherto it has only been recorded from Bloxworth Heath.

Gen. Euophrys, C. L. Koch.

Euophrys æquipes, Cambr. List. Brit. and Ir. Spid., p. 72.

An adult male on the porch of Bloxworth Rectory, June 17th, 1900. An unusual habitat, its nearest hitherto recorded locality being the Isle of Portland.

Gen. Hasarius, Sim.

Hasarius Adansonii, Sav.-Cambr. List Brit. and Ir. Spid., p. 73.

An adult female found in a plant-house at Oxford in 1900 was kindly sent to me by Mrs. Veley, Oxford.

Gen. SYNAGELES, Sim.

Synageles venator, Luc.-Cambr. List Brit. and Ir. Spid., p. 74.

Two immature males found by Dr. A. R. Jackson near Glamorgan in 1901. A very rare spider.

DESCRIPTIONS OF NEW SPECIES.

AGROECA NOTATA, sp. n.

Agroeca chrysea, Kulcz., non L. Koch.

Adult male, length 1½ lines; length of female, rather over 2 lines. This species is nearly allied to *Agroeca chrysea*, L. Koch. It is, however, of a less golden hue; the dark markings on the abdomen are much more distinct than those of *A. chrysea*, L. Koch, and the pale dentated band along the middle of the upper side of the abdomen is enlarged at its hinder extremity immediately above the spinners, where it forms a large and rather conspicuous pale patch. The broad dark brown lateral longitudinal bands on the cephalo-thorax are traversed by pale radiating lines, and the marginal line is blackish. The upper side of the caput is almost immaculate and is of a large wedge-shape, joining in with the narrower longitudinal pale band on the thorax.

The *legs* are yellowish brown, the femora, tibiæ, and metatarsi of the first and second pairs and the femora of the third and fourth pairs strongly suffused with blackish brown. The femora have a rather distinct, but not very regular, pale annulus about the middle; that on the femora of the first pair appears to be larger and more diffuse than that on the rest.

The *palpi* appear to have the digital joints rather larger than those of *C. chrysea*, L. Koch, and the palpal organs also differ in

form. The genital aperture of the female differs from that of that species, but agrees with the figure given by Prof. Kulczynski of his *A. chrysea.* The female is more distinctly marked than the male.

I have compared *A. notata* (here described) with typical examples of *A. chrysea* received from Dr. L. Koch himself, and also with others, nearly allied, from Continental Europe. One received many years ago from France (from M. Eugéne Simon), and named *A. chrysea*, L. Koch, is certainly the same as the one here described.

Adults of both sexes were found not uncommonly among herbage on the cliffs at Folkestone in 1901 by Mr. Cecil Warburton and kindly communicated to me. It has not been before recorded as British.

MICRONETA CAUTA, sp. n. (Fig. 2.)

Adult male length 1-13th inch; length of female 1-11th.

This spider is nearly allied to *Microneta conigera*, Cambr., and may easily be mistaken for it; it is, however, a more richly coloured spider; the tibiæ and metatarsi, especially of the first and second pairs of legs, being of a deep brown hue, the rest being reddish orange yellow. The lower part of the clypeus is prominent, in a rather rounded sub-conical form.

The *palpi* have the characteristic excavated conical protuberance on the outer side of the digital joint strongly developed and its summit is a little curved. The palpal organs are well developed and complex; they differ in structure and form from those of *M. conigera*, but the figure alone will convey a distinct idea of them. From near the lower part of the fore extremity of the cubital joint rather on the outer side there are 2 (or 3) bristly hairs close together and directed forwards.

The female resembles the male in colours. The form of the genital aperture (see figure) is very distinctive, and differs from that of *M. conigera.*

Examples of both sexes were found by Dr. Randall Jackson near Glamorgan in 1901.

ENTELECARA JACKSONII, sp. n. (Fig. 6.)

Adult male length, 1 line.

Cephalo-thorax, short, broad, rounded in front; lateral marginal impressions at the caput slight, elevation at the occiput (looked at from above and behind) large, nearly round, the fore side a little flattened, and slightly depressed in the middle between the hind-central eyes, with a strong longitudinal cavity or indentation at its base on each side. The height of the clypeus is considerably less than half that of the facial space. Colour, bright orange-yellow; the fore part of the elevation and the region of the fore-central eyes strongly suffused with blackish.

Eyes of the hind-central pair near the fore margin of the cephalic elevation, nearly two diameters apart; the rest form a straight transverse line, the two lateral pairs very wide apart, each pair on a strong tubercular black eminence. The fore-central pair are nearly an eye's diameter apart on a slight prominence, from which issue some short black coarse hairs; other divergent hairs occur between those mentioned and the base of the cephalic elevation.

Legs 4, 4, 2, 3, tolerably strong, not greatly different in length; colour, yellow, the fore extremities of the femora, the tibiæ, metatarsi, and tarsi suffused with dusky blackish. They are pretty thickly furnished with strong bristly hairs.

Falces orange-yellow.

Palpi similar to the legs in colour and armature; cubital joint slightly clavate; radial shorter, but without any terminal apophysis; digital joint large, somewhat truncate at its fore extremity, and with a strong obtuse sub-conical prominence at its base on the inner side; this prominence is furnished with a group of short bristly hairs on its inner side. Palpal organs prominent, complex, and furnished on their outer side with a long, strong, tapering, circularly-curved spine.

Maxillæ yellow. *Labium* yellow-brown.

Sternum as broad as long, somewhat heart-shaped, hollow-truncate in front; surface very convex, furnished thinly with long

coarse hairs; posterior extremity broadly-obtuse and truncate; colour orange-yellow, margins black, and suffused with blackish round the margins.

Abdomen short, broad-oval; upper convexity strong, glossy-black, furnished with short hairs.

The *female* resembles the male in general appearance and colour, as well as size; but the caput, of course, wants the cephalic eminence. The eyes are on black spots, those of the posterior row are in a line, the convexity of whose moderate curve is directed backwards. The four centrals form a square, whose fore side is shorter than the rest. The length of the fourth pair of legs appears to be distinctly greater than that of the first. The genital aperture is very characteristic, though somewhat difficult to see accurately.

Both sexes of this very distinct species were found and kindly sent to me by Dr. A. Randall Jackson. They were found in the spring and summer of 1901 in a swamp in the Rhondda Valley, near Glamorgan, South Wales. I am not yet entirely satisfied about the generic position of this spider, though at present I cannot see what other group is better fitted to receive it.

ENTELECARA OMISSA, Cambr.

Entelecara omissa, Cambr. List Brit. and Ir. Spid., p. 75.

Adult male length 1-16th of an inch.

Cephalothorax dark yellow brown with deeper dusky markings, indicating the normal indentations. Eminence on the caput moderate, sloping in a convexly-curved line backwards to a hollow at the thorax, which rises a little at the posterior slope; a small curved but distinct and slightly curved indentation runs backwards from between the hind-lateral and hind-central eye on each side. The height of the clypeus rather exceeds half that of the facial space.

Eyes small, sub-equal. The hind-central pair are on the fore part of the cephalic eminence rather more than an eye's diameter apart; the fore-central pair are larger than the hind-central, on a small prominence and seated near together but not quite

contiguous to each other, forming a line equal in length to the hind-centrals. The fore-centrals with the fore-laterals form a slightly curved line (looked at from in front), the convexity of the curve directed forwards. The four centrals form a rectangle whose opposite sides are equal, but its length greater than its width.

Legs slender, orange colour, furnished with hairs only; moderate in length, 4, 1, 2, 3.

Palpi similar to the legs in colour; the radial and digital joints tinged with yellow brown. The radial joint is large, with an obtuse prominence on its outer side; its fore extremity is produced into a long, strong, curved, obtuse, hollow apophysis truncate at its extremity, directed outwards, and from about the middle of the joint underneath towards its outer side a strong obtusely-pointed projection, projects at nearly right angles, reminding one of that connected with the same joint in *Entelecara erythropus*, Westr. The digital joint has a conical prominence near its extremity on the outer side. The palpal organs are highly developed, prominent, with a fine black spine in a small prominent coil at their extremity on the outer side.

Sternum blackish brown, very convex, glossy, heart-shaped, and its posterior termination broadly obtuse.

Abdomen black, glossy, clothed scantily with short fine hairs. Found in Wicken Fen by the late Mr. William Farren.

Wideria Warburtonii, sp. n. (Fig. 8.)

Adult male, length rather less than 1 line.

Cephalothorax narrow-oval, lateral marginal impression at the caput slight; occiput very slightly raised, with a slight but perceptible dip in the profile line behind the back of the caput. Running backwards from between the lateral and central eye, on each side, of the posterior row is a straight tapering, but not strong, indentation. Colour yellow-brown, the sides suffused with a darker hue, shewing the position of the converging thoracic indentations, and having an indistinct pale marginal stripe.

Eyes large, all pearly greyish white, the fore-centrals perhaps slightly darkest; the laterals, on each side, with the fore-centrals,

are all contiguous to each other, and form an uninterrupted semi-circle. Those of the posterior row form a very nearly straight transverse line, its eyes being separated by less than an eye's diameter. The height of the clypeus is equal to half that of the facial space.

Legs moderately long and strong, 4, 1, 2, 3, furnished with hairs and a very few slender bristles. The tibiæ of the first and second pairs are distinctly stronger than the metatarsi; colour yellow, tinged with orange.

Palpi similar to the legs in colour; radial joint greatly produced at the extremity on the outer side into a long tapering, straight apophysis, whose point is directed rather outwards, and a shorter curved obtuse apophysis at its inner extremity. Digital large; palpal organs prominent and complex, with a strong corneous tapering curved, pointed spine at their extremity on the outer side.

Falces moderate in length and strength, vertical, and of a yellow brown hue.

Maxillæ, *labium*, and *sternum* normal, colour pale yellow.

Abdomen elongate-oval, almost cylindrical, thickly clothed with hairs.

A single example found by Mr. Cecil Warburton, at Cambridge in the autumn of 1900. Its narrow elongate form gives it much resemblance at first sight to one of the Dysderidæ.

Wideria incerta, sp. n. (Fig. 9.)

Adult male, length 1-13th of an inch.

Cephalothorax pale orange brown; *legs* and *palpi* pale yellow; *abdomen* pale yellowish brown, thinly clothed with fine hairs.

This spider had evidently only recently effected its final moult; the colours, therefore, would no doubt have shortly become much richer and more pronounced. It is nearly allied to *W. cucullata*, C. L. Koch, but the form of the caput and of the radial joint of the palpus are very distinct (*vide* figures). A small slightly tumid space immediately behind and above the fore-central pair of eyes is of a darker colour than the rest and

furnished with short hairs. When I first found this spider I fancied that, from the imperfectly developed palpal organs, it might possibly be *W. cucullata* awaiting yet another moult, but the perfectly and distinctly formed radial joint of the palpus, and well developed caput, when closely compared to the adult *cucullata* have led me to describe it as a new species.

Hab.: Bloxworth, among moss and dead leaves in May.

WIDERIA SUBITA, sp. n. (Fig. 10.)

Adult female, length $1\frac{1}{3}$ line.

Cephalothorax yellow-brown; normal indentations indicated by darker converging dusky lines.

Eyes rather large, not greatly differing in size, occupying the whole width of the fore extremity of the caput, and all pearly white, the fore-centrals slightly greyish; those of the posterior row are in a straight transverse line, separated by very nearly equal intervals of rather less than a diameter. The fore-centrals are smallest and almost contiguous to each other; the fore-laterals largest. The four central eyes form a trapezoid, whose anterior side is rather the shortest, and its longitudinal distinctly longer than its transverse diameter. The height of the clypeus is less than half that of the facial space.

Legs slender, moderately long, 4, 1, 2, 3, furnished with hairs and a few fine bristles, and of a pale orange-yellow colour.

Falces dark yellowish brown.

Maxillæ, *labium*, and *sternum* normal in form; colour dark yellow brown, the sternum with a black marginal line.

Palpi similar to the legs in colour, but furnished with stronger bristles; the radial joint is rather tumid and about equal to the digital in length.

Abdomen oval, moderately convex above; colour yellowish brown, fairly clothed with longish hairs; inferior spinners, longest and much strongest, superior spinners distinctly two-jointed. Close in front of the inferior pair is a long tranverse semi-circularly curved slit, opening doubtless into a spiracular organ. The genital area is large, and of a very distinct and characteristic form

(see Fig. 10*a*). No possible description is, as a general rule, by itself sufficient to give the peculiar structure and form of the sexual parts, which in numberless instances furnish the strongest, and sometimes the only, tangible specific distinction in female spiders.

A single example of this species was found by myself in September, 1900, among coarse grass and herbage on Ralsbury Camp, near Bulbarrow, Dorset. Its colours, indicated above, are scarcely reliable, as maturity had not long been attained.

Lycosa promptula, sp. n. (Fig. 11.)

Adult female, length 3 lines.

Cephalothorax longer than broad; lateral marginal indentations at the caput moderate, Colour yellowish, ocular area deep blackish brown, with two elongate, yellowish, parallel patches between the posterior pair of eyes. Following this backwards is a central, quickly tapering, longitudinal band as wide as the ocular area at first, pinched in a little before the thoracic indentation, at which it ends in an obscure point; on each side of this is a broad longitudinal lateral band streaked with converging transverse dark brown lines. Between this band, on each side and the margin, is a yellow one covered with grey hairs; and the marginal line or stripe is dark brown and obscurely defined.

Eyes normal. The area of the four large posterior ones is slightly longer than broad, and distinctly widest behind. The four small anterior eyes are of equal size, separated by very nearly equal spaces of an eye's diameter; if anything, the central space is slightly larger than the others. The line formed by these four small eyes is curved, the convexity of the curve directed forwards; the two central eyes are seated on a rounded prominence, and the interval between each of the lateral eyes and the large eye immediately behind it is rather greater than a diameter of the former. The height of the clypeus exceeds the diameter of a fore-central eye.

Legs furnished with spines, moderate in length and strength, 4, 2, 1, 3; colour yellow, the femora and tibiæ banded tolerably distinctly with dark yellow-brown, the bands on the femora are

mostly divided by transverse yellow lines, giving them a rather spotted appearance. The metatarsi are also indistinctly banded.

Maxillæ, *labium*, and *sternum* dark brown.

Abdomen deep brown above with a longitudinal central tapering, reddish yellow-brown hand, formed by a coalescence of the normal transverse bars or chevrons, whose divisions are indicated by a narrow paler angular line or chevron at the base of each. The normal fusiform, central, longitudinal marking at the fore extremity is obscurely indicated. The under side of the abdomen is yellow brown. The genital area is large, somewhat rectangular, longer than broad, of characteristic form and structure, differing from that of any other species yet known to me. I found this spider near Swanage several years ago, and have delayed its record hoping to have been able before this to turn up others of it, but as yet without success.

ORDER PHALANGIDEA.

Gen. OLIGOLOPHUS, Sim.

Oligolophus Hansenii, Kraepelin.

Examples of this phalangid were received from Mr. W. Evans, by whom they were found at Elvan-foot and Leadhills, Scotland, in 1900.

LIST OF SPECIES.

(With Reference to Page and Fig.)

ARANEIDEA.

PHALANGIDEA.

Sketch of Ground near Weymouth.

Scale 3 inches to a mile, or $\frac{1}{21120}$.

Scale of Yards.

Scale of Miles.

Scale of Slopes.

C J Russell Colonel R.E. retd
Clanna, Weymouth.

Notes on the Reading of Contoured Maps.

By Colonel C. J. RUSSELL, R.E. (Retd.)

(Read Dec. 3rd, 1901.)

CONTOURS are the intersections of ground by equidistant horizontal planes. DEF. 1.

They serve the following purposes :—

I. To show at a glance the absolute and relative levels of any points on the map—within such limits as the vertical interval between the contours allows.

II. To indicate by their distribution along any line which crosses them, whether the slopes are steep or gentle, being close together in the former case, wider apart in the latter.

Also what is the exact degree of slope in any case by seeing on the scale of slopes which division corresponds to the space on paper between two successive contours.

III. To show by their shape and bends the various features met with in any ordinary country—the ridges, spurs, hills, crests, and watersheds, the cols (or saddles), watercourses, valleys, ravines, &c.

IV. To determine the visibility or otherwise of any point from another and, if invisible, the height it is necessary to gain vertically above one point to see, or be seen from the other.

V. To determine the best direction and trace of any level or graded line such as a railway or road and to show the necessary cuttings, embankments, or tunnels involved, in their proper places, also the width and height of the cuttings and embankments at any point thereon when the trace is decided.

To explain these five uses, the first is obvious ; the second may require three or four terms to be defined ; so also the third ; and some simple rules may be given as regards the fourth and fifth.

The reasonings or proofs which govern the definitions and rules need not here be stated, but in the grouping or tabulation adopted certain analogies and contrasts will be observed which may suggest the underlying principles.

II. DEFINITIONS.

H.E. *(Horizontal Equivalent).*—The horizontal distance in which a given difference of level will occur at a given degree of slope expressed in yards. DEF. 2.

V.I. *(Vertical Interval).*—The difference of level between two specified points expressed in feet. DEF. 3.

D. *(Slope).*—The angle of elevation, or depression, above or below the horizontal plane expressed in degrees. DEF. 4.

$\frac{1}{n}$ *(Gradient).*—The slope expressed as the ratio of the V.I. to the H.E., *e.g.*, 1 : 8, *or* 1 *in* 8, *or, as a fraction*, $\frac{1}{8}$. DEF. 5.

The relation between the first three terms may be thus stated.

H.E. × D. = V.I. × 19·1. (Horizontal Equivalent × Degree of Slope = Vertical Interval × 19·1).—The factor 19·1 being the cotangent of 1° in yards, the V.I. being 1 foot. The formula holds good for any slope up to 15° (1 in 4), after which it entails error. RULE 1.

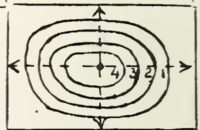
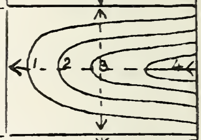
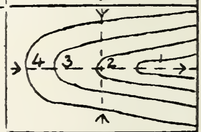
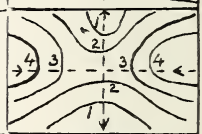
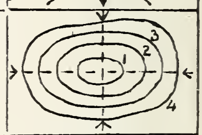
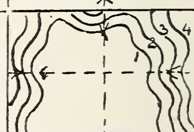
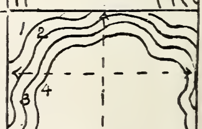
As, however, in the great majority of cases, observations are within this limit, it is useful for determining any one factor when the other two are ascertained. Outside this limit trigonometrical tables must be referred to.

The use of two methods of expressing a slope is the result of custom.

Astronomers, sea captains, and artillerists deal with degrees. Engineers have the monopoly of gradients, and have common-sense on their side, as it seems scarcely worth while adopting a graduation for small *vertical* angles, which depends on the whole circle being divided into 360 degrees. However, while both methods are in use, custom and age have to be respected, and the degree is the popular unit.

To turn a degree into a gradient divide it by 60. RULE 2.
,, gradient into a degree multiply it by 60.

III. CHARACTERISTICS OF ORDINARY GROUND.

Term.	From Point thereon out of 4 directions the Ground		Where occurring.	Effect on Contours.	Diagram in Illustration.
	Rises in	Falls in			
Hill or Knoll (point)	—	4	Convexity on Watershed	Form Rings	
Watershed (line)	1	3	Ridge or Spur	Bend Outwards	
Watercourse (line)	3	1	Valley or Ravine	Bend Inwards	
Col or Saddle (point)	2	2	Concavity on Watershed	Counter-bend	
Crater (point)	4	—	Water finding outlet below	Form Rings	
Alluvial Ground (edge line)	1 or more	—	Level Space of Low Ground	All outside and above	
Plateau (edge line)	—	1 or more	Level Space of High Ground	All outside and below	
Cliff (edge line)	—	1 or more	Section Surface Exposure	Stop dead	

It may be noticed that a hill (or knoll) and a crater are reciprocal terms, also a "watershed" and a "watercourse" and, again, "alluvial ground" and a "plateau."

Either inverted constitutes the other; a col inverted remains a col; and a cliff would still be a cliff.

The order of figures of the contours becomes reversed as a result of the inversion suggested.

Should a contoured map be without figures, the presence of water will at once indicate which is the high and which is the low ground, and the figures can be supplied accordingly.

This figuring in complicated ground has its minor difficulties, often due to failing to observe that the same contour must be repeated on each side of a watershed and of a watercourse, *i.e.*, at a change from ascent to descent and *vice versâ*.

Referring to the first purpose (I.) served by contours, certain limits are indicated, *e.g.*, the levels of points intermediate between contours cannot be indicated by the contour lines themselves.

Where the V.I. is 25 feet the summit of a hill may be 22 feet above the highest ring contour, and can be indicated by its figure, *e.g.*, 72 in the ring showing the 50 contour.

If the knoll were situated on a spur, it is usual to show it by a dotted ring, otherwise the existence of this knoll could not well be recognised.

Such dotted lines are called *form lines*, and they can also be placed longitudinally between contours to show where there is a sudden change of slope within the 25 feet limit, which is not otherwise legible. The use of form lines is, however, exceptional and depends on the purpose of the map itself.

Exercises.

Take a piece of tracing paper and place it over the map, mark clearly throughout their length.

Q. 1. The two primary watersheds between the three streams running N. and S., also any branch watersheds and any water-courses between.

Q. 2. On the W. of map there are seven watersheds running W. to E. and six watercourses between them. Show these, also any branch watersheds and watercourses.

Q. 3. Along the various watersheds resulting from (1) and (2) show on the tracing each knoll—watercourses blue, watersheds brown chalk lines.

It may be necessary here to explain the term "crest." The *real* crest of a feature is its watershed, but the *apparent* crest may be a line roughly parallel to it either on the near or further side, according as the observer is below or above its level.

It is this *apparent* crest which causes convexity, concealing the ground immediately beyond it, and it generally agrees with the contour nearest to which the slope of the ground changes from a gentle to a steep one.

Anyone who, noting these characteristics, walks over hilly or undulating ground with a contoured map in his hand, and compares the map with the ground, will soon be able to read the map of an unknown country and form an accurate conception of its features in his mind. At this stage he is in a position to solve many questions of an interesting nature, which are also useful and important for many purposes.

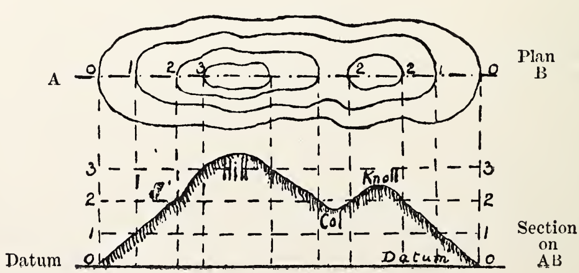
IV. QUESTIONS OF VISIBILITY.

DEF. 6. A "section" is the intersection of ground by a vertical plane.

It is thus a line on which the various contours that cross it are expressed as points, which are the intersections of this line by equi-distant parallel straight lines representing the contour planes.

The relation between a plan and a section is represented thus:—

Sketch 2



A section can always be constructed on any line which crosses contours in plan.

A plan can always be constructed from a series of sections.

The map-reader should, however, be able to decide on all matters—as to which a section affords information—without resorting to the process of constructing a section.

Visibility questions depend on whether the general section between the end points concerned is concave or convex. Concavity means visibility; convexity means invisibility.

In convex ground some one point (or crest) in the section rises above the line connecting the end points in the vertical plane.

In concave ground no point rises above it to interfere with the line of sight.

The question then becomes of this nature. Does any crest of the few or many that cross the line (in plan) crop up above this line, or which of them appears most likely to do so?

If *no* point between is higher than either of the ends, the section is *obviously* concave and the ends mutually visible. RULE 3.

If *any* point between is higher than both ends, the section is *obviously* convex and the ends mutually invisible.

The crest which intervenes, and which is selected as the critical one, may, however, be higher (or lower) than one end while lower (or higher) than the other. With a pencil and a penny ruler and a slight calculation, the question of convexity or concavity may be solved without reference either to the scale of a map or to the vertical interval between contours, and without drawing a section of the ground.

Thus let A and B be the ends of the line and C the intervening crest.

AC is the foreground from A, the background from B.
BC ,, ,, ,, B ,, ,, ,, A.

AC and BC both have a vertical interval or height H and h differences of contour figures.

AC and BC both have a horizontal equivalent or distance D and d, inches on paper.

$$\begin{array}{l} \text{If, looking up} \\ \text{,,} \quad \text{down} \end{array} \Big\} \frac{H}{D} \text{ greater than } \frac{h}{d} \text{ or } Hd > Dh \left\{ \begin{array}{l} \text{convex} \\ \text{concave} \end{array} \right.$$

$$\begin{array}{l} \text{,,} \quad \text{up} \\ \text{,,} \quad \text{down} \end{array} \Big\} \frac{H}{D} \text{ less than } \frac{h}{d} \text{ or } Hd < Dh \left\{ \begin{array}{l} \text{concave} \\ \text{convex} \end{array} \right.$$

RULE 4. The view line AB may skim the crests and run high above the hollows; it will thus be concave and A and B mutually visible. But if one point, C, crops up above AB, it will be convex and A and B mutually invisible.

If, when thus tested, the section is convex, the question may arise—what height is it necessary to gain at either end to see, or be seen from, the other end?

RULE 5. Here, instead of comparing Dh with Hd, we equate them—Dh = Hd and substitute the three known values and calculate the fourth, viz., the height *above* or *below* C (according as we are looking *up* or *down*). We thus obtain the absolute level expressed in contours which has to be gained for visibility.

The following exercises, if practised and verified, will further help to give an insight into the art of reading contoured maps.

EXERCISES.

The line CC is given as a watershed.

If so, any point thereon lower than either of its immediate neighbours indicates a col.

Any point higher than either—a knoll (or cross watershed).

Q. 4. Show how all contours, 1 to 9, cross CC thus $\cap$ and thus $\cup$ (in pencil).

Each col suggests a watercourse rising below it and tending towards lowest figures in A and B.

A	C	B	Results.
·1	·7	·9	Convex
·8	·5	·4	Concave
·9	·6	·2	Convex
·4	·3	1·	Convex
·3	·4	·5	Convex
·8	·9	6·	Convex obvious
·11	·8	·7	Concave
·5	·2	·4	Concave obvious
Figures are those of nearest contours (numerical order).			

D & d in quarter inches.		H & h in contour differences.		
Height for A from B	Hd : Dh	hD : dH	Height for B from A	
4·6 up	6 × 5 > 6 × 2	2 × 6 < 5 × 6	down 12	Convex
— down	3 × 4 > 5 × 1	1 × 5 > 4 × 3	up —	Concave
9·2 down	3 × 5 < 4 × 4	4 × 4 > 5 × 3	up 2·25	Convex
4·66 down	1 × 6 < 5 × 2	2 × 5 > 6 × 1	up 1·8	,,
3·2 up	1 × 5 > 4 × 1	1 × 4 < 5 × 1	down 5·25	,,
11·5 down	—obvious—	—obvious—	up 10·2	,,
— down	3 × 5 > 6 × 1	1 × 6 < 5 × 3	up —	Concave
— up	—obvious—	—obvious—	up —	,,
A		C	B	

Q. 5. Show these by sinuous blue lines.

Each knoll suggests a cross watershed starting thence and tending towards highest figures in A and B, *or* to the low point indicating the junction of any two watercourses between which it lies.

Q. 6. Show these by pencil lines.

Q. 7. Draw neat red contour lines to suit all figures and to suit each other, avoiding harsh convergences and divergences, but let slopes merge gracefully and naturally. For this purpose other cols and knolls may occur on the cross watersheds. Rings for knolls, but drawn out for ridges. Counter-bend for colls)⌣⌢(Inward bends for watercourses; contours like hairpins. Outward bends for watersheds; contours like horseshoes (because water does just as much work as it is obliged to, but no more).

AA on left are points of observation towards BB on right.

BB on right ,, ,, ,, AA on left.

CC assumed as the possible crest of concealment between AA and BB.

Q. 8. Verify the tabulated figures which give the results "convex" or "concave" in the diagram; also the heights A and B require to be raised to in order to see or be seen from each other.

V.

Rule 6. Assuming we wish to trace a road through hilly ground with a maximum gradient of $\frac{1}{15}$ (or slope 4°), the vertical interval between contours being 25 feet and the scale of map $3''$ to a mile. If it is necessary to cross contours that indicate steeper ground, this should be done obliquely, taking $\frac{25 \times 15}{3} = 125$ yards off the map scale and stepping it from contour to contour as required (with dividers), due regard being had to the general direction of the road; and this may require a more or less zigzag trace on steep ground.

Or, if there is a scale of slopes on the map, the equivalent for 4° will be found to give the same result. (Cuttings and embankments not here resorted to.)

Again, if a straight line crossing a contoured map represents a railway, and its end levels are those of the ground itself, and it is evenly graded from end to end.

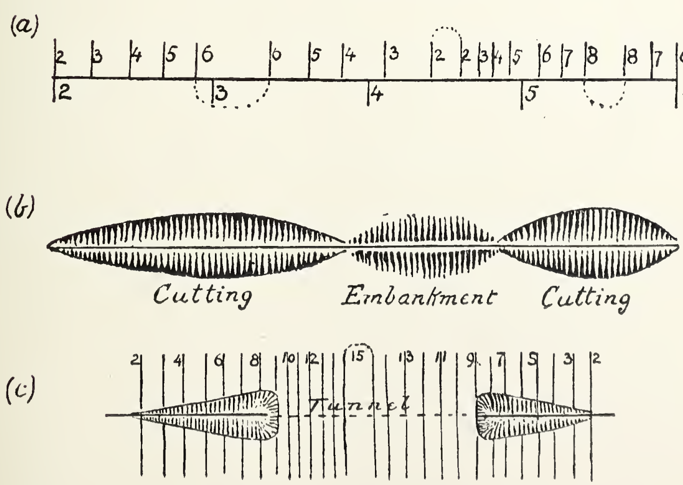
The figures above the line are those of the ground contours.

,, below ,, ,, ,, graded line.

By comparing the figures at any point above and below the line, we can at once see whether that point on the graded line is above or below the ground, *i.e.*, whether it is embankment or cutting. We thus get the outline in plan of the top edge of the cuttings and of the foot of the embankments, also the position and length of tunnels. **Rule 7.**

Incidentally, this method of grading a straight line between two end points would settle the question of where the intervening crest (referred to in IV.) lay—if it were a visibility question—as any portion of the straight line which goes underground means a convexity. The point of greatest disparity is then the crest in question. **Rule 8.**

Sketch 3.



The map which accompanies this paper may supply a few questions for practice as illustrations of V. and of the subject generally, in addition to those already given, 1-8.

Q. 9. Between a straight line running E. and W. 100 yards N. of Wyke reservoir and another running W. from Radipole Church indicate by shading all the ground unseen from contour 225 (No. 9).

Q. 10. Trace a road max. gradient $\frac{1}{20}$ from Wyke reservoir to join the Chickerell Road and another from W. Chickerell, same ruling gradient over the col S.W. of Buckland Ripers to join the Abbotsbury Road.

Q. 11. Trace a railway from contour below Radipole Church, going under Wyke ridge, and joining the existing railway near the Torpedo Works, showing by hachures the embankments, cuttings, and tunnel exits.

Q. 12. From the Breakwater Fort—level of eye 25 feet—show the crest (or skyline) on the map surface throughout.

All these exercises could be done on tracing paper to which the contours may have been transferred.

The foregoing notes, as well as the map, are the result of carrying on instruction in military sketching over the ground pourtrayed.

This instruction is, of course, an important part of military education, and, to those who have an aptitude for the work (the cases are more or less exceptional), it is an extremely interesting part.

There is no reason, however, why the subject, at least to the extent of map reading, should be confined to military students or surveyors.

It is quite within the grasp of the educated and intelligent student of nature.

The Seeing Power of Beasts and Birds.

By H. J. MOULE, M.A.

TO speak of a failure in the eyesight of wild animals sounds like a token of lunacy. "What!"—the hearer would say—"What! As if any man's eyes are equal in keenness to those of every beast and bird! What nonsense to talk of a failure of any kind in their eyesight! The man must be a lunatic!" Just so, and yet, "greatly daring," the writer wishes to bring before the club that very idea. His puzzle is to understand why some beasts and birds appear not to see a man although in full view, if he is stock still. The fact is undoubted. Most likely every one here could speak of instances witnessed by himself. To the writer this experience has perhaps come more often than to some others, for he is much given to solitary sketching. Now, when you are standing or sitting, quite still, with a sketch-book in use, and in a quiet field or wood, you have a rare chance of seeing more things than the landscape and your attempted pourtrayal thereof. The glimpses of the manners and customs of some beasts and birds which thus come to you are quite unspeakably charming and interesting. A few of such glimpses

which have fallen to the lot of the writer, always as a sketcher, may be rehearsed.

While he was sketching by the stream-side in Frome Billet Down, West Stafford, two kingfishers thought the best place for a free fight was within a dozen feet at most of the wholly unperceived sketcher. It was an astonishing sight to behold those two birds darting and dodging about in the air, flashing like jewels as the sun's rays caught them at all sorts of angles, and most viciously prodding at each other with their long bills. The battle went on for about two minutes, but without bloodshed, as far as could be seen.

Another time a sketch was going on quite near Dorchester, at the entrance of Slyer's Lane. There is an iron bar crossing a little watercourse which was being sketched. The bar was certainly not ten feet from the sketcher. Presently there was a blue flash, and a kingfisher perched on the bar. He preened himself a bit, sharpened his bill on the said bar, looked about quite happily, and wholly without view of the sketcher. Then he flew on up stream in blissful ignorance of the nearness of his supposed natural enemy. Presently his place was taken by a thrush of equally unperceiving mind.

Another time, at Mr. Floyer's beautiful river-side, the Allers, West Stafford, a sketch was begun, carried out, and ended on one side of a bush while, as it seemed, a heron was all along on the other side watching for fish. At all events, on the sketcher moving, up got the heron from within a very few feet. He was in a terrible fluster, and flapped away at his utmost pace. Yet he had never seen the sketcher till he moved. So much for unperceiving birds.

As to beasts—that is, small ones—it is a thing that has repeatedly happened that mice of more sorts than one have disported themselves in peace of mind close to the writer while sketching. This occurred, for instance, quite lately. He was doing a "bit" in a barley field of Mr. Hayne's during last harvest. There was a rustle in the stubble. "A mouse," thought the sketcher. The next moment the mouse ran against

his foot. "Dear me! that stone wasn't here yesterday," the little animal seemed to say to itself. It turned away quite quietly, and moved on calmly hunting for scattered barley corns. The beauty of its lithe movements, seen at three feet or so from the eye, and of its lovely red coat contrasted with the pale barley-straw colour and green stubble-plants, was a sight worth beholding.

A few days before this another pretty thing of the sort happened. The writer had been sketching by the south-west corner of Yellowham Wood, and was walking down the heath track to Higher Bockhampton. Presently a white-tailed squirrel appeared about twenty yards away. He was steadily galloping up the white sandy path, most likely returning from a raid in Mrs. Hardy's garden. The writer stood stock still. On galloped the squirrel. At about ten feet off it stopped and looked about; seemed, too, to sniff and listen, but clearly did not see the foe, for it started again quite steadily, passed the writer's feet within a very few inches, and, without the slightest hurry, galloped on towards Yellowham Wood, where doubtless was its abode.

But the most interesting of these near glimpses of our timorous four-footed neighbours is that which will now end this rehearsal.

On a February day a few years ago the writer was sitting by the Stratton roadside, sketching a bit of the snowy West Ward with Burton Mill in the background. He was close over a culvert which leads water under the road into a large pool about two hundred yards beyond the first bridge, on the right or east side of the road. In the strong stream from the culvert, only eight or nine feet from the sketcher, was a mass of water crowfoot in its early matchless green and waving with its wonderful grace. Presently came a water vole, strenuously swimming up stream. It gave swift snaps at the water crowfoot. This action at first the writer could not understand. But the vole explained himself. The first snaps were failures, caused seemingly by the strong stream making it hard for him to take a

steady bite. He hit it off, however, at last. He got a hold of the upper end of the floating part of one of the trails and bit it off. Then, holding the end in his mouth, he swam on close under the writer's feet, which were less than a yard over his head, quite unknowing. Here, again, as in the case of the red field-mouse, a fine chord of colour resulted. The brown vole, the six-foot emerald waving trail of crowfoot, both set off by the grey of the water, were a study indeed.

At the outset the writer carefully said "some" beasts and birds fail in sight at times. He says it again, for he by no means denies a full power in some kinds of both those orders of seeing the stillest man. How still soever he has been, and for however long a time, he does not remember having been confidingly visited during his sketching by rooks, those exceedingly clever birds. The robin, too, he believes to have a full power of seeing even a completely motionless human being. But that inquisitive and confiding creature is drawn, not driven away, by the sight.

There are other exceptions among birds and beasts likewise. But, as a general rule, there is no doubt that to be still is to be unseen by many wild things. And the puzzle comes in how this is? A likely answer is that it is a deficiency of reasoning power in them. But, on thinking over the subject, it is surely true that a very low reasoning power is exerted by us superior beings in the perception of objects round us, moving or still, living or not. The kingfisher, the thrush, the squirrel, and the field-mouse are undoubtedly quite as rational as we are in taking a view of things that surround them and concern them. And think how greatly human beings concern them. The vole and the thrush, if we rightly place ourselves in their point of view, live in a world infested by a gigantic race possessed with an undying, unresting hate towards voles and thrushes, all and sundry. Yet let the giant only be still, and let his eyes not meet their eyes; they feed close to him or rest close to him, not knowing of him at all. Now, would it be so with men? Suppose this land to be thickly peopled with, say, rogue elephants, consumed with

eagerness to get hold of a man and tread him flat. In our walks abroad, continually in fear of rogue elephants, should we be blind to the huge grey bulk among the trees because it happened to be as still as a stone? We trow not. Yet, as said above, it is surely a very small measure of reason, no more than a vole's or a thrush's, that would be exerted by a man in catching sight of a savage elephant standing still. So the writer confesses to being much puzzled, and would fain be instructed as to the inwardness of this phenomenon. Long may the said phenomenon last on, for it produces much pleasure.

There is a quite unspeakable delight in a close view of the ways and dodges, of the mode of life, of bird or beasts almost touching man, yet fondly thinking murderous man far enough off. That brown water-vole, swimming strongly, but peacefully, up the grey stream, with the long emerald crowfoot trail, bearing it close below the writer's feet, to eat it at leisure in its hole above the culvert—well it showed up a picture ever to be seen, ever delightful, even to the end of life.

The Snows of Canada.

By VAUGHAN CORNISH, D.Sc., F.G.S., F.C.S., F.R.G.S.

WHEN my wife and I arrived at Montreal in the middle of December, 1900, the snow was already about a foot deep. The thermometer was low, not rising much above zero; the sky was overcast and the air still, but very damp and chilling. Frost fogs loaded every branch and twig thickly with rhyme. There was no sun to illuminate these decorations, but in the avenues of the city at night the powerful arc lights shone upon the frosted trees, and showed the shimmering of minute ice needles floating like dust-motes in the air. When the sun came back to us there was a thaw, then frost, more snow, and so on, with uncomfortable vicissitude until the end of the month. During this time the St. Lawrence was also in the transition stage, covered with ice floes, no longer navigable, and not yet frozen so as to be fit for sledges. With the New Year came better times, a brighter sky, with drier air and more consistent cold; the ice began to "take" on the river, and there were a good many windy days, sometimes with snowfall, sometimes with brilliant sun. It is not everyone who looks upon

wind as an advantage during the Canadian winter, but, as we had come to study the snow and snow-drifting, it was welcome to us. The winter before we had been in the Highlands of Scotland for the same purpose. In East Canada the snow is, on the whole, colder, and therefore drier and more mobile, than in the Highlands; and the snow-banks are due less to deposit during windy snowfalls and more to the subsequent drifting of the already fallen snow. Calling the snow which is merely driven before the wind during snowfall *driven* snow, and that which is subsequently removed from the surface and carried to places of shelter *drifted* snow, we may say that the snow-banks which we saw in the Highlands were mainly of driven snow, in East Canada, to a great extent, of drifted snow, and in Manitoba and the north-west territories almost wholly of drifted snow. Round Montreal in the first half of January I saw on several occasions recently-fallen loose snow drifting across the open fields in waves, each wave advancing by the settlement of snow against its steeper lee side, whilst the exposed weather face was losing snow at the same rate. These snow waves were very much like the large ridges which strong tides produce on some sandbanks, but are not so steep. When, for instance, the interval from ridge to ridge is fifteen feet, the height of the ridge is about five inches in the case of snow waves and one foot in the case of the tidal sand waves.

Some curious waves are produced artificially on the snow-covered roads and streets by sledge-driving. If a bank of snow be thrown across the road, as is sure to occur in places when the snowfall has been accompanied by wind, the sledge, if driven quickly, jumps at the top and bumps down on the other side, pushing away the snow before it and making a hole and a second ridge. As the traffic proceeds both ways, the ridges and furrows extend in both directions from the original bank, and the road soon assumes the appearance of a long train of symmetrical round-topped waves, each ridge stretching quite across the roadway. They are called *cahots* (jolts), and well deserve their name. The motion in a sledge rapidly driven over

the *cahots* closely resembles that of a sailing boat when head to wind in a choppy sea. The snow pushed from the hollows to the ridges is there pressed together and helps to build them up. Thus the inequalities increase by the simultaneous lowering of the troughs and raising of the ridges, and the process is more rapid than that by which holes are worked in an ordinary road, where most of the detritus does not go to build up the ridges, but is carried away by rain water into drains or ditches. The snow ridges were very well developed on the sledge route across the St. Lawrence, which was in use before we left Montreal in the middle of January. Here was the finest winter scene that I met with in East Canada. The contrast between the stretches of level ice and the hummocky tracts, where upward pressure of pent-up water had smashed the frozen surface, was especially striking. Between these rough floes the sledge track winds, marked out by young fir trees called *billees*. On Sundays and holidays the ice road presents an animated scene as the sledges pass to and fro between the city and the opposite shore, a distance of two miles, and visits are exchanged between the town and country folk.

Westward, from Montreal as far as Port Arthur at the end of the chain of great lakes, a distance of one thousand miles, the snow did not vary much in its character; but at Winnipeg, 1,400 miles from Montreal, on the level prairie of Manitoba, with a drier climate and greater cold, we found the snow conditions very different. The snowfall was less, and it did not long remain where it fell, but was continually chased from place to place by the winds which blow over the open prairie. When the wind is strong and the sky free from ordinary cloud, and the temperature is at or below zero Fahrenheit, which is a common combination in winter at Winnipeg, the air in the streets of the city usually remained clear and almost free from snow, although the sun was dimmed by something like a dust cloud, and halos, &c., indicated the presence in the air of icy particles. As one approached the limits of the city, however, and looked out upon the open prairie, one saw a very different state of things. The

snow was drifting so thickly near the ground that nothing could be distinguished through it, and only the upper parts of buildings stood out clearly from the white haze of whirling drift, which was something like the spoon-drift in a storm at sea. How is it, then, that the air in the streets remained clear? Either the drifting snow got past the city or it did not. If not, there must have been enormous snow-banks produced on the windward side, whereas the snow-banks there were not of great size; but there was much snow on the more sheltered side of the city in the woods, &c. It appears, therefore, that a great part of the drifting snow got past the city, and the remaining question is, did it go round or did it jump over? Taking into account the wide spread of the city, and how insignificant is the height of the houses in comparison with that breadth, and, having examined the snow-banks in the suburbs, I came to the conclusion that a great part of the snowdrift was wafted over the city.

After a snowfall accompanied by low temperature the wind removes the non-adherent, loose, dry snow from the open fields, drifting it in waves, and most of it accumulates in the woods, the river gullies, and in the neighbourhood of houses or other fixed obstructions. The distance to which an isolated house upon the prairie affects the depth of the snow is much greater than would be supposed from one's experience of snow-drifts in Britain. Unfortunately, the horizontal distances are so great in comparison with the vertical heights that it is not easy to obtain with an ordinary camera a photograph showing the whole thing on a sufficiently large scale. The principal accumulation of snow is a bank shaped something like an elongated horseshoe, with the house situated near the base, which is the windward end, and separated from the bank by a bare space, which is kept clear by the action of the wind. Near the house, sometimes in contact with it, on the lee side is an accumulation of snow much smaller in cubic contents than the bank which half encircles the house, but more conspicuous to photograph from its shape and its position against the dark background of the house itself. Further to leeward the action of the wind, as modified by the

neighbourhood of the house, keeps the ground nearly or quite clear of snow between the two arms or horns of the drift, and this clearing action frequently extends beyond the distance to which these arms or horns can be traced.

A snow-bank formed on the lee side of a clump of bushes is often terminated by a cliff or cornice, which is the form familiar to most of us. It is, however, a transition form due to insufficient supply of snow. As the winter goes on, and more snow is supplied from time to time, the cliff will diminish in height as its distance from the bushes increases, and the final form of the snow-drift will be that of a long tail of snow behind the bushes, highest not far to leeward of them, and tapering gently down to the general level of the snow, or to the level of the ground.

Between the snowfalls the wind is so active that the black friable soil of the prairie is exposed in places and drifts before the wind, so that the curious effect is often seen of wind-formed ripples in the snow outlined along their summit by the granules of black earth.

The snow, which remains long upon the ground, subjected to low temperatures, to the sun's rays, to condensation of moisture at night, to the mechanical action of the wind, and, now and again, to thaw, is gradually altered in its consistence until it is no longer an aggregate of flakes, of plates, of needles, or of stars, but is quite granular, like sand. It is this kind of snow which, when blown about by the wind, falls into ripples, almost exactly like those which the wind produces in the dry sand of the desert or the seashore.

Westward of Winnipeg, nearly as far as Medicine Hat (2,048 miles from Montreal and 660 from Winnipeg), the snow at the end of January was of the same character as near Winnipeg itself, much of it being granular, and the freely-drifting snow on the open prairie frequently took the form of isolated crescentic patches, with two horns, like the horns of a crescent moon, pointing forward. This is a form in which desert sand often drifts. At Calgary, 2,264 miles from Montreal, the ground was nearly free from snow, evidently the result of the

westerly *chinook* wind, which, kept relatively warm by condensation of water vapour during its ascent of the mountains, and heated by compression during its descent, licks up the snow with surprising rapidity. On our return journey in February we encountered a *chinook* at Moose Jaw in Assiniboia, between Medicine Hat and Winnipeg. The thermometer rose to 40° Fahrenheit, from *minus* 20°, and at each gust of wind one could see the snow shrinking away, the chief melting taking place along a series of parallel, sinuous, lines, giving a rippled look to the surface. The prevalence of this wind in the more western parts of the prairies is important among the conditions which render them suitable for raising stock.

In crossing the Rockies we found the snow deep upon the ground, but there was nothing very remarkable about its appearance. In the next range cf mountains, however, the Selkirks, things became much more interesting. Throughout this district the snow lay deep, and hung in clinging masses of rounded form upon tree stumps and other excrescences. Within a limit of about 10 miles, *i.e.*, 5 miles east and west of Selkirk Summit, the highest point in these mountains attained by the C.P.R. line, these rounded masses of snow developed into a very strange and beautiful feature of the scenery. Having journeyed on to Vancouver, and made sure that there was no more snow further on equal to this, we returned without loss of time to Glacier House Station, which is situated at an altitude of 4,120 feet, and is distant only two miles from Selkirk Summit. The Glacier House Hotel is kept open throughout the winter, which avoids the necessity of dragging the heavy dining cars up steep gradients. Here we stayed, with the great peaks, Sir Donald, Cheops, and the rest, six thousand feet above us, and the silent forest around, with its wonderful crop of "snow mushrooms." The snow lay five feet deep upon the ground, this being the thickness to which the twenty-five feet of measured snowfall had subsided by the gradual escape of the entangled air. There is little wind in this high valley, the temperature of the snowfall is generally at or above 32° Fahrenheit, the precipitation is very

great, and the snowflakes usually large. Under these conditions the falling snow is of the clinging kind which tends to go into rounded masses. We were blessed with bright skies during most of our stay, which is not the usual condition there during winter. We also saw something of the other aspect of things during two days when snow fell continually, without a breath of wind or a gleam of sun, the whole valley a grey monotony of silence.

The first incident of the day of public interest was the arrival of the "Glacier House Gazette," which consists of such items of news passing on the wires as the station master deems of importance to Glacier House. During our stay an event occurred in the history of this journal, a typewritten being substituted for a manuscript page. We took up the whole issue, which remains in our possession. Later in the day arrived "Number 1," the eastbound train, for an early luncheon, then "Number 2," the westbound train, for a later luncheon, after which nothing particular happened until the next morning; but a great peace settled upon the silent valley, only the shadows and the colours changing as the sun swept round beyond our mountain walls.

It was, however, a busy, as well as a most delightful, time for us, for there was much to be done in examining, measuring, and photographing the great bosses and caps of snow, sounding depths, determining the specific gravity of the snow, and the rate of subsidence of snowflakes, developing photographs, and so forth. Locomotion was necessarily slow and laborious, and a good deal of time was occupied in thoroughly exploring even a small area in search of all varieties of snow cap. The snow, nowhere less than five feet deep, had no crust upon the surface, so that, even with snowshoes, one sank in some way. Then the large flakes or plates of which it was composed would not slip through the mesh of the shoe, as the snows of the prairies do, so that at each step one had to raise or drag a great weight of snow; and on the steep slopes the snowshoes were awkward to use. I ought perhaps to have been provided with a special class

of snowshoe which they make for these parts, but I had only the shoes I had bought in Montreal, which served me excellently except in the Selkirks. On the other hand, I found it easier than I anticipated to get about without snowshoes, for the snow did not hold one much, but was fluffy, not sticky, in the cold weather which prevailed during our stay. It is near Glacier House that the great snow avalanches occur, and the trains are carried under the massive snow sheds, over which avalanches shoot safely into the valleys. The line here is watched by a picked staff of men, reliable fellows and excellent company, and is patrolled by engines furnished with rotatory and other snow ploughs. The engineers of the C.P.R. are the first authorities in the world on the handling of snow, and railway people who have to contend with similar difficulties come from three continents to learn their methods.

From the waving tops of the slender cedar, spruce, and Oregon pine the clinging masses of snow are readily detached, but here and there in the forest a broken trunk presents a broader and firmer pedestal, on which a snow-cap forms and grows with each succeeding snowfall until it attains the maximum dimensions compatible with the area of the platform and the cohesion of the snow. The largest snow-cap which I met with was perched five and twenty feet above the ground on a broken trunk, which at that height was four feet in diameter. The snow-cap was twelve feet six inches across, so that the eaves of snow projected four feet three inches beyond their pedestal. In the neighbourhood of the railway track many trees have been felled for use in construction. A stump several feet high is always left, and these make pedestals for snow-caps. When the snow is five feet deep upon the ground, the only indications of the shorter tree stumps are the bosses of snow above them, but the longer stumps support a detached snow-cap, stump and cap together looking exactly like a great mushroom. The cap of snow upon the top of the stump is well placed to encounter, and has a surface well adapted to retain, the snowflakes as they settle with uncertain flight; the cap grows out beyond the margin of its

pedestal and thus shelters, as an umbrella, the ground at the foot of the stump. Thus there is a hollow beneath each mushroom, and this was the case also with those which in late winter only showed as bosses, owing to the rise of the snow level all round them. Hence it is treacherous ground near the edge of these bosses, and one may readily fall through into a pit almost empty of snow.

The tree stumps are commonly from two feet to two feet six inches across, and, at the time of our visit, these supported snow-caps about nine feet in diameter. Upon this base I do not think much more snow could accumulate. On the other hand, if the stumps were giant trees such as are met with nearer the Pacific, having a diameter of, say, fourteen feet, a snow-cap five feet thick would have more the appearance of a flat roofing or thatch of snow with projecting eaves, and would therefore not be so striking a feature in the landscape. Smaller trees, on the other hand, cannot support the whole depth of so great a snowfall, and the cap, having a smaller thickness, there is not sufficient pressure to squeeze out the air from the lower layers, and thus weld the snow into a tenacious mass. The snow-caps on the stumps of smaller trees are therefore not only less striking, but are unstable and soon fall; whereas the large snow mushrooms are remarkably stable and seem to be practically permanent during the continuance of winter. Thus there is round Glacier House such a happy proportionality between the size of the forest trees and the depth of the winter snowfall that wherever a tree is felled there grows in its place a great snow mushroom.

The Nesting of a Pair of Missel Thrushes from the Observations of Mrs. N. M. Richardson.

By NELSON M. RICHARDSON, B.A., F.E.S.

(Read December 3rd, 1901.)

A CERTAIN relative of Mrs. Richardson's, who used to write poetry rather well, had a wife who, when her husband's writings were praised, would say "Ah, yes, John wrote it, but I give him all the ideas; he merely makes the rhymes." This was not, I believe, strictly accurate in that case, but in the present instance I feel rather like that unfortunate gentleman, for what is put down as *my* paper is taken entirely from a series of most elaborate and patient observations made by Mrs. Richardson on the nesting of a pair of missel thrushes last spring. The only part I have contributed is the photographs.

We have generally had at least one pair of missel thrushes building in our garden at Montevideo (in the parish of Chickerell, near Weymouth), but this year (1901) a pair were so obliging as to build their nest in the fork of an apple tree only about 11 feet distant from one of the first floor windows. The only trouble was that there was no second story in that part of the house, and one could not, even from the top of the window, see well down into the bottom of the nest. The birds, especially the hen, were very shy and took fright at the least

movement, which caused considerable difficulty in taking the photographs. I could only manage it by drawing blind and curtain, and hiding everything but the shutter of the camera, and even then the snap of the shutter always frightened away the hen, though the cock occasionally stood his ground, though alarmed. Had it not had this protection, I could not have got near enough to take a photograph which would show the bird with an ordinary lens.

The "cleaning of the nest" mentioned in the notes, refers to the following process, which was usually performed by the cock whenever he fed the young ones, but occasionally by the hen. After he had finished feeding the young ones, one of them would put up its tail and wag it, upon which the cock would immediately jump round to that side of the nest, and place his beak under the tail of the young bird to receive the dropping which it thereupon emitted. This the cock always swallowed until the last two or three days, when he carried it off to a considerable distance from the nest. He was once seen to drop it at a distance of about 30 yards, so that it may be presumed that whenever he carried it away he did not swallow it. The same remarks apply to the hen when she performed this process. After finishing with one young bird he would, as a rule, attend to the others in the same way. This method of cleaning the nest is not, I believe, confined to the missel thrush, but is practised by, at all events, some other birds, and accounts for the extreme cleanliness of their nests, which could hardly otherwise be obtained.

The total number of times on which one of the old birds was observed to feed the young ones was 84, out of which number they were fed only 11 times by the hen and 73 times by the cock. The hen was occupied during so much of the time in sitting on the nest that she had probably usually enough to do whilst off to obtain sufficient food for herself. She was twice observed to take part of that brought by the cock and give it to the young [Ap. 5, 12.29 and 12.43 p.m.].

I append here a table giving the dates and times of all the feedings observed.

TABLE I.

Showing Times of Feeding Young Birds on Different Days. All the Feeding by the Cock, unless otherwise Stated.

The numbers on the right hand of each column are the intervals between successive feedings given in minutes. The numbers in brackets are the number of feedings observed during the day.

Ap. 3.	Ap. 4.	Ap. 5.	Ap. 6.	Ap. 8.	Ap. 9.	Ap. 10.
4. 4	12.12	11.44	10.50	3.22	11.33	12. 0
10	10	30	15	5	31	3
4·14	12.22 Hen	12.14	11. 5	3.27	12. 4	12. 3
16	2	8	18	18	3	9
4.30	12.24	12.22	(3) 11.23	3.45 Hen	12. 7 Hen	12.12 Hen
14	31	7	—	10	6	11
4.54	12.55	12.29		3.55	12.13	12.23
32	33	14		—	10	10
5.26	(5) 1.28	12.43		(5) 4.43	12.23	12.33
17	—	20		—	21	17
5.43		1. 3			(6) 12.44	12.50 Hen
32		17			—	4
6.15		1.20				12.54
28		23				24
6.43		(8) 1.43				1·18
4		—				12
6.47						1.30
6						5
(10) 6.53						1.35 Hen
—						5
						(11) 1.40
						—

Ap. 11.	Ap. 14.	Ap. 16.	Ap. 18.		Ap. 19.	
3.47	1. 4	(1) 7.30 p.m.	11. 0 Hen	Two young birds.	11.10	Only one young bird.
8	4		3		5	
3.55 Hen	1. 8		11. 3		11.15	
18	5		—		—	
4.13	1.13		12.57	Only one young bird.	12.34	
4	7		7		3	
4.17	1.20		1. 4		12.37	
15	14		7		15	
4.32	(5) 1.34		1.11		12.52	
13			9		3	
4.45			1.20		12.55	
5			5		3	
(7) 4.50 Hen			1.25		12.58	
—			2		2	
			1.27 Hen		1. 0	
			1		—	
			1.28		(9) 3. 0	
			—			
			2.44			
			26			
			3.10			
			3			
			3.13			
			5			
			3.18			
			12			
			(14) 3.30 Hen			

Table II. gives the longest, shortest, and average intervals between successive feedings in minutes. Fractions of minutes smaller than quarters are not counted.

TABLE II.

SHEWING THE LONGEST, SHORTEST, AND AVERAGE INTERVALS BETWEEN SUCCESSIVE FEEDINGS.

	Ap. 3.	Ap. 4.	Ap. 5.	Ap. 6.	Ap. 8.	Ap. 9.	Ap. 10.	Ap. 11.	Ap. 14.	One young bird only. Ap. 18.	Ap. 19.
Longest interval ..	32	33	30	18	18	31	24	18	14	26	15
Shortest ,, ..	4	2	7	15	5	3	3	4	4	1	2
Average ,, ..	$18\frac{3}{4}$	19	15	$16\frac{1}{2}$	11	$14\frac{1}{4}$	10	$10\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{3}{4}$	$5\frac{1}{4}$
No. of consecutive feedings observed	10	5	8	3	4	6	11	7	5	7& 5	2 & 6

From this table it will be seen that the average interval between the feedings decreased irregularly from $18\frac{3}{4}$ and 19 minutes on the two first days to $7\frac{3}{4}$ and $5\frac{1}{4}$ minutes on the last two days, when (except during the two first recorded feedings of Ap. 18, which I have not included in this table) there was only one young bird under observation, the other two having flown. The shortest time noted between two successive feedings was one minute [Ap. 18, 1.27—1.28 p.m.]; but the first of these was by the hen, the second by the cock. The shortest interval between two successive feedings by the cock was two minutes on one occasion [Ap. 19, 12.58—1.0 p.m.] and three minutes on several occasions. The shortest intervals between successive feedings by the hen were 38 and 45 minutes, both on April 10. The average interval, taking into account all the observations during the whole 16 days, was 12 minutes, so that, supposing feeding to have gone on at this average rate for 14 hours a day, the number of meals required by a young missel thrush until it left the nest would be something like 70 a day, or a total of over 1,100!—each young bird devouring perhaps 700 or more worms,

if we assume that the cock brought about two worms at a time, besides elm seeds and ivy berries and a few other miscellaneous objects.

It is interesting to compare these results with a similar case of a missel thrush's nest with three young ones mentioned in Morris' British Birds (1853 edn., Vol. iii., p. 25), where the number of meals observed in one day was 66, the feeding beginning at 4.30 a.m. Morris gives the earliest date at which building has been observed to commence as April 3rd, eggs having been found on the 6th, but in the present case the eggs were hatched on the earlier of these two dates, and building was commenced on March 3rd.

The following notes were taken by Mrs. Richardson when watching the birds.

March 3, 1901. On this day I heard a missel thrush calling in a peculiar manner to its mate. I looked out of the window and saw it sitting on the branch of an apple tree close by; the other one flew up from the bottom of the garden and settled in the tree, close to the first. As soon as it settled, the first one hopped into a fork formed by 3 or 4 branches coming out of a thick branch and began to scratch with its feet and scuffle with its wings, as birds do when taking a dust bath. It then hopped out of the hollow, and the second one, after looking at the place with its head on one side for a moment, hopped in, and went through the same performance. It then hopped out, and both looked at the place for a minute or two, and flew off.

March 4. The next day I was unfortunately ill in bed all day, so could not tell what went on, but on the morning of

March 5, A good deal of nest had been built of dead grass in the fork so carefully investigated by the birds. I saw no work being done to the nest that day, and, there being a good deal of wind, it began to blow away.

On the morning of March 6 no more had been done to the nest, and in the course of the day it all blew away. I had not once seen the old birds go near the nest since the 3rd inst., and I feared that they had quite deserted.

On March 7 nothing was done.

On March 8 I saw that there were one or two little pieces of moss put into the fork, but I did not see the birds go to the tree at all; they must have done this early in the morning, as I always went to see in good time, and nothing more was done all day.

On March 9 they had done a great deal with dry grass and moss early in the morning, and worked very hard all day chiefly with moss, making a very pretty nest, as the moss was for the most part brilliantly green.

On the morning of March 10 the nest was quite finished outside and the birds were working hard at lining it with mud. They continued at this all day, finishing off with fine dry grass, and got it done by the evening, having practically taken only two days to build it. It was very interesting to watch the way in which they made their mud lining: the bird flew to a small pond on the other side of the house where the mud is very clean, took up a good beakful, came back to the nest and put the mud in; it then hopped into the nest, sat down very hard, slightly raising its wings so as to be able to sit down lower, and scrabbled vigorously with its feet. It then turned so as to face another way and again pressed itself down and scrabbled with its feet: this it did four or five times, and then went off for more mud. Both birds seem to work at the nest about equally.

On the morning of March 11 the nest was quite finished, and I did not see anything at all done by the birds until March 17, when the hen laid her first egg.

She laid again on March 18, 19, and possibly 20, but of this last I am very doubtful, as only three young birds were hatched, and I saw nothing of the fourth egg. She always laid in the morning.

March 20 was a very cold, wet day, rain all day with a cold east wind (the nest is thoroughly exposed to the east, but sheltered on the west by the house). The hen was on the nest when I first saw her in the morning; went off at 10.0 a.m., and returned shortly before 11.0 and stayed on all day till 6.0 p.m.,

FIG. 1.—HEN MISSEL THRUSH SITTING ON NEST.

[From a Photograph.

I regret to say that the Birds in the Illustrations very inaccurately represent those in the original Photographs and Drawing, owing to the improper and so-called artistic touching up by the Engravers.—N.M.R.

FIG. 2.—COCK MISSEL THRUSH STANDING ON EDGE OF NEST.

[From a Photograph.

when she went off for about a quarter of an hour, and then came back and settled down on the nest. She continued to sit till April 3 in the middle of the day.

The hen turns the eggs occasionally, raising herself in the nest, putting down her head and turning them with her beak; she does not sit on the edge of the nest to do it. She comes off very regularly, soon after 10.0 in the morning for 15 or 20 minutes, and again for the same time at about 6.0 in the evening; but, after she had been sitting about 10 days, she began to come off oftener, but only for a very short time on the occasions between the two regular times of 10.0 a.m. and 6.0 p.m. When she is frightened off, and sometimes when she goes off without being frightened, the cock comes and stands on the edge of the nest (as in the photographs exhibited), though he never sits on the eggs, and does not leave till she comes back again. He can never go far away, as he comes almost directly she goes. He often attacks a pair of magpies which are building about 50 yards off, driving them out of the trees if he thinks they are coming too near. Once another pair of missel thrushes came to look for a nesting place in the same walled garden, but he would not allow them to stay, flying at them with great vigour and much noise; he drove them out of the walled garden (which is about 40 yards by 30 yards) into some trees in front of the house, well out of sight of the nest, where he did not seem to mind them.

One day, April 1, I saw the cock standing on the edge of the nest feeding the hen, who was sitting, with what I feel sure was a worm: this is the only time I have seen him feed her.

April 3. At about 2.30 p.m. the cock came and sat on a branch close by the nest, the hen being off. A sparrow came, I suppose nearer than he liked, and he flew at it and drove it away. The hen came back in a very short time and the cock left.

3.5 p.m. I looked again and the hen was off, but came back almost directly and stood on the edge of the nest: she was followed at once by the cock, and both stood on the nest, one on one side, one on the other, looking in with their heads on one

side. They then began to peck up pieces of eggshell very gently out of the bottom of the nest, and swallow them; then the cock flew away and the hen settled down on the nest, but very lightly, sitting very high, and often putting her head down and feeling very gently with her bill under her breast, and rising up and putting her head on one side to look down into the nest. The hen seemed distinctly to have gone and called the cock to come and see the newly-hatched young birds and to help to clear up the egg shells. This was exactly 14 days after March 20, the day on which she began to sit.

3.15 p.m. The cock came again and they went through the same process of clearing up. Probably a second young one had hatched.

3.40 p.m. The cock came again and the hen went off. This time he brought two very small worms, with which he fed the newly-hatched young, putting his head down into the nest; the nest is too deep for me to see to the bottom.

3.45 p.m. The hen came back, but brought no food; she settled down on the nest.

4.4 p.m. The cock came to the nest without any worms, but he seemed to bring up from his throat a semi-liquid pale grey substance, with which he fed the young. This he did twice, waiting for about a quarter of a minute between and moving his throat to get the food up. The hen went off when the cock came and returned at 4.9 p.m., bringing no food.

4.14 p.m. The cock came with food, but I could not see what. The hen sat on the side of the nest whilst he fed the young, and went on again when he had finished.

4.30 p.m. The cock came with food, not worms, but soft food; the hen flew away. The cock cleaned nest. The hen came back at 4.33 p.m., bringing no food. I have only seen the cock bring two worms distinctly.

4.54 p.m. The cock came with a considerable quantity of worm in his bill, but it was middle-sized worm, cut into small pieces about ½ inch lengths; with these he fed the young (and afterwards cleaned nest); the hen went away, returning at

4.59 p.m. without any food. She sits down on the nest very carefully, much more so than when there were eggs. It was raining a little when she went off this time, but she did not seem to mind leaving the young in the rain; it was not at all hard rain and it was a very mild day.

5.26 p.m. The cock came back with food, but I could not see what; he then cleaned nest; the hen went away and came back at 5.35 p.m. bringing no food.

5.43 p.m. The cock came with soft food, no worm; the hen stood on the edge of the nest whilst he fed the young (and cleaned nest); she took a little of the food from his beak, it looked milky and something of the consistence of treacle; he then flew away and she settled down on the nest. This was the only time that I saw the hen take any food brought by the cock for the young. She seems much pleased with the young, often raising herself up and putting her head down under her breast to look at them.

6.11 p.m. Hen went off, probably for her evening feed, though it is raining somewhat.

6.15 p.m. Cock came and fed young with soft food, I think; sat for a minute on a branch near, then flew away.

6.23 p.m. Hen came back and settled down on the nest, but brought no food.

6.43 p.m. The cock came with food, worm I think, fed young: the hen flew away.

6.47 p.m. The cock came again with food, it was too dark for me to see what; before he had finished feeding the young the hen came back and sat on the edge of the nest till he had done; she then settled down and he flew away.

6.53 p.m. The cock came again with food; the hen sat on the edge of the nest, and went on again as soon as he had fed the young. I stayed watching until 7.20 p.m., when all the birds had left off singing, and it was nearly dark, but nothing more had happened.

April 4. This morning I have seen the hen come to the nest, but she brings no food.

12.12 p.m. The hen went off and the cock came with a rather small worm in two halves, with which he fed the young. He then gave them some soft food which he seemed to have in his throat.

12.22 p.m. Hen came back with two small worms and fed the young, but seemed to have some difficulty in getting them to take them; she then settled down on the nest. This is the first time I have seen the hen feed the young.

12.24 p.m. Cock came with soft food, the hen got off and sat on the edge of the nest, whilst he fed the young. He has no trouble in getting them to take food from him: he has had more practice. He flew away and she settled down on the nest.

12.55 p.m. Hen flew off: cock came with two small worms and fed young, then flew away.

1.4 p.m. Hen came back with no food and settled down on nest.

1.28 p.m. Hen flew off on seeing cock coming with small worms, with which he fed the young and then flew away.

1.32 p.m. Hen came back without food.

The hen has never, during the whole time she has been sitting, seemed at all dull or drowsy, as fowls do. Both cock and hen have been extremely quiet since they began to build. I think one of the old birds always keeps an eye on the nest: this morning a starling settled on the tree when neither of the old birds was there. It evidently saw the young and was much interested, looking down at them, with its head on one side, from a little way off: then it hopped on to a nearer branch, and then still nearer, eyeing the young birds with the greatest interest. When it got to within about a yard of the nest, the cock missel thrush flew up straight at the starling and drove it away.

April 5. Very rainy with sleet; in hard rain the hen sits very close, puffing out the feathers on her breast so as to cover the top edge of the nest, and half spreading her wings in a slanting down position, thereby making a sloping roof, which throws off the water and keeps the inside of the nest quite dry by covering over its top edges. She is very careful to keep her head to the

FIG. 3.—HEN MISSEL THRUSH SITTING ON NEST DURING HEAVY RAIN,

WITH WINGS PARTLY EXTENDED TO PREVENT RAIN FROM ENTERING THE NEST.

[From a drawing by Mrs. Richardson.

wind to-day. I exhibit here a sketch which Mrs. Richardson took at the time of the hen sitting in this position.

11.44 a.m. Hen went off; cock came with small worms, fed young, and left.

11.45 a.m. Hen came back.

12.14 p.m. Cock came and fed young. Hen sat on edge of nest, and, after he had done feeding them, she helped him to clean out nest. This is the first time I have seen her do so. She then settled down on nest.

12.22 p.m. Rain over. Hen left, cock came with worms, fed young, and flew away. This is the first time I have seen the young put up their heads, and open their beaks, for food.

12.28 p.m. Hen came back without food and settled down on nest.

12.29 p.m. Cock came with worm rather larger than usual; hen sat on the edge of the nest whilst he tried to get the young to take the worm, but they would not. The hen took it out of his bill and tried, but they would not take it the first time; but, on her trying to induce them a second time, one of them took it and swallowed it. The cock then flew away, and the hen cleaned the nest and settled down on it.

12.43 p.m. Cock came with food, I could not see what; the hen again helped to feed the young, each old bird sitting on one side of the nest; then the hen settled down on the nest. It was raining again, but not very hard.

1.3 p.m. Cock came and fed young: hen flew away, but came back in about a minute and settled down on nest.

1.12 p.m. The hen tucked her head round under her back feathers, and seemed to settle herself for a sleep, but only for a minute or two. This is the only time I have seen her do this, but she may have done so after dark.

1.20 p.m. Cock came and fed young, and hen sat on the edge of the nest.

1.43 p.m. Cock came and fed young and hen flew away. The rain had ceased.

1.50 p.m. Hen came back and settled down on nest.

FIG. 4.—COCK MISSEL THRUSH FEEDING YOUNG WITH WORM.

[From a Photograph.

3.27 p.m. Cock fed young with worms.

3.45 p.m. Hen came back with one large worm and gave it to a young one: another was much disappointed and held its mouth open for some time: the hen settled down on the nest and the cock came also directly with more worms, fed young and flew away: the hen sat on the edge of the nest meanwhile. As soon as he was gone, she began to pull again at the thing in the bottom of the nest, but without success, so she settled down, but got up again on the edge of the nest in a few minutes to have another pull, still unsuccessful.

3.55 p.m. Cock fed young with worms, hen flew away.

4.6 p.m. Hen came back.

4.43 p.m. Cock came with several worms, fed young, then flew away.

April 9, 11.33 a.m. Cock fed young. As soon as he had done so, hen came and settled down on nest.

To-day the young are left alone much more, and they sit with their chins resting on the sides of the nest, and their bills wide open, a great deal. The eyes of the young birds seem to be quite shut up; there is only a dark appearance where they ought to be, as if they were covered by a semi-opaque skin.

12.4 p.m. Cock came and fed young. Taking a photograph had frightened off the hen a short time ago, and she has not come back again.

12.7 p.m. Hen came back, fed young, and settled down.

12.13 p.m. Hen flew away; cock came and fed young with several worms, then flew away.

12.23 p.m. Cock fed young and flew away. He always brings them worms now, so far as I see.

12.44 p.m. Cock came with very large worms, fed young, and flew away.

April 10, 12.0. Cock fed young and flew away; hen came almost directly, brought no food, but sat on the edge of nest some little time looking at the young, then settled down on nest.

12.3 p.m. Cock came, fed young; hen flew away.

12.12 p.m. Hen came back with large worms, fed young, and settled down.

12.20 p.m. Hen flew away.

12.23 p.m. Cock came with several large worms, fed young, and flew away.

The three young seem to be now insatiable; they mostly have their heads up out of the nest, or resting on the edge, with their bills wide open, even directly after they have been fed.

12.33 p.m. Hen came back, sat first on a branch close to the nest looking at the young, then on the edge of the nest; then the cock came with one very large worm, fed one young one, and flew away; hen cleaned nest, thought for a moment, then flew away, and I heard one or both birds chattering loudly, as if at a cat or a magpie, but could not see them.

12.50 p.m. Hen came with one worm, fed young, and settled down.

12.54 p.m. Cock came with worms, fed young, and flew away; hen had flown away.

April 10. I have not heard the old birds speaking to the young to-day or yesterday.

1.0 p.m. Hen came back and settled down.

1.17 p.m. Hen flew away and chattered much in the garden.

1.18 p.m. Cock came with at least three very large worms, fed young, and flew away; he was careful to give each a worm.

1.30 p.m. Cock fed young and flew away.

1.35 p.m. Hen came back, fed young, and had a great pull at the thing in the bottom of the nest. She got some of it off and swallowed it, then pulled and got off more and swallowed, and so on for several times. Then she settled down on the nest as if satisfied, having carefully examined it with head on one side.

1.40 p.m. Hen flew off; cock came with a great many worms, fed all three young. In his haste to satisfy them he gave them more than they could swallow, so that some fell out of their bill into the nest; these he picked up carefully and gave them again.

Yesterday, and still more to-day, the cock has sat on a branch near the nest when the hen was away, keeping watch over the young. Can it be that, now that they put their heads out of the nest and wave them about, they are more attractive to the eyes of magpies, &c.? Both old birds, but especially the cock, have attacked the magpies several times, chattering and flying at them when they saw them in the trees by their own nest, which is about 50 yards away and in the adjoining flower garden in a tall ash; the missel thrushes are more than a match for the magpies, I think.

April 11. The young are eight days old and are getting some feathers. They are now dark grey on the head and back, with large tufts of pale grey down on each side of the head and on the hind parts. Their eyes are not open yet.

3.45 p.m. Hen settled down on nest.

3.47 p.m. Hen flew off; cock came with worms, fed young, and left.

3.55 p.m. Hen came back with worms, fed young, and settled down on nest.

4.13 p.m. Hen flew away; cock came with worms, fed young, flew away.

4.17 p.m. Cock came back, fed young, and flew away.

4.32 p.m. Cock came, fed young, and sat on a branch near, watching.

4.43 p.m. Hen came back, but I do not think she brought any food; looked at young, and flew away again.

4.45 p.m. Cock came with several very large worms, fed young, and flew away. It was amusing to see how carefully he put the end of a worm which had fallen out of the side of the bill of a young one back down its throat.

4.50 p.m. Hen came, fed young, and settled down on nest. The hen always sits on the young at night; the cock goes on feeding them till nearly dark, after 7.0 p.m.

April 12. Things went on much the same as usual, but the wind has been cold, in the east, so that the hen has been more on the nest. The young birds grow fast and are very voracious;

they now rise up quite high in the nest when the old birds come, and I have even seen one of them spread out its wings and flap them to-day.

April 13. Things went on much the same. The young grow fast, eat largely, and are losing much of the light-coloured down.

April 14. To-day the young birds are 11 days old, and, for the first time, I have seen their eyes open; they also stretch out their wings in various directions and clean their feathers with their bills, though rather clumsily. They are getting very restless, and often seem to make the hen so uncomfortable by putting up their heads with open beaks, stretching their wings, &c., that she cannot sit properly on the nest, but has to sit on the edge and puff out her breast feathers over them.

1.4 p.m. Cock came, fed young; hen cleaned nest; cock flew away.

1.8 p.m. Cock made a little harsh cry; hen flew off; cock came with several ivy berries, fed young, and flew away.

1.13 p.m. Cock came with one large worm, fed young, and flew away.

1.20 p.m. Cock came with one large worm, fed young, and flew away.

1.31 p.m. Hen came, but brought no food; she had been sitting on a currant bush near for some time. She settled down on the nest.

1.34 p.m. Hen flew away; cock came with several worms, fed young, and flew away.

The down is coming off the young birds fast; they seem to clean it off their bodies with their bills, and get it off their heads sometimes by scratching with their feet, sometimes by rubbing their heads under their wings.

One young bird is stronger and more active than the others; he sits on their backs and flaps his wings, and is altogether more lively.

On one occasion the cock brought one or two smallish worms and one very long one; two of the young birds got hold each of an end of the long worm and swallowed it as far as they could.

This disturbed the cock much; he watched them for a few seconds and then took hold of the worm between the two bills, but it did not come in half, so he did it again, with the same want of success. He then caught hold of it and pulled it up out of the throat of the young one who had had a worm before and gave it into the bill of the one who had not.

April 15. I think that the young have to-day been fed on elm seeds as well as worms, as I saw several elm seeds on the edge of the nest, and there are no elm branches from which they could have dropped; also, I looked carefully on the ground underneath and could find none.

The hen is now very little on the nest, except at night and when it rains or hails, when she covers over the nest most carefully with her half-stretched wings. She still feeds the young very little, but sits on a branch near and watches them. The cock works very hard.

April 16. Very windy from the north, so that the nest caught the wind. The young birds kept as low as they could, but they are now so big that they could at best only be flat with the edge.

When I first looked, at about 9.30 a.m., there were no elm seeds on the edge of the nest, but when I came again, soon after 10.0, there was one. After I had watched a few minutes, one of the young birds raised its head somewhat and opened its bill a little, slightly shaking its head. It then ejected an elm seed out of its mouth on to the edge of the nest. This it did three times at intervals of about half a minute; one fell into the nest and the last caught on its feathers, very likely taken there by the wind. It then settled down quietly. In a minute or two the cock came with worms, and the young bird of the elm seeds seemed the most excited to be fed, and got the most. After the cock had fed them, he carefully picked the seed off the young one, but did not pay any attention to the two on the edge of the nest or to the one in the nest, which last he could not see, as the young covered it.

7.30 p.m. The cock came and fed the young birds, but I do not think the hen came to them at all after that. I watched till

it was so dark, almost 8 o'clock, that I could not see any more, and she had not come then. This is the first night that she has not slept on the nest.

April 17. The birds are a fortnight old to-day.

One is much more advanced than the others; it has now got rid of all the down on the head and back, and is quite covered with feathers there and on its breast; it nearly always sits on top of the others. The cock was this morning very careful to feed one of those underneath.

April 18. One of the young birds must have flown, as I can only see two, and the third was so very lively yesterday.

11.0 a.m. The hen came and fed them with something round (ivy berries or elm seeds) and flew away.

11.3 a.m. Cock came and fed young with worms. I had, unfortunately, to go away till

12.30 p.m., when another young bird had gone, the second strongest one.

12.57 p.m. Cock came and fed the one young bird with ivy berries; hen came directly, cleaned nest, and flew away.

I picked up a quantity of elm seeds just under the nest this morning.

1.4 p.m. Cock came, fed young one, and flew away.

1.11 p.m. Cock came again, fed young one with elm seeds, and flew away.

1.20 p.m. Cock came, fed young one, and flew away; he always goes now in the direction of the elm trees and ivy.

1.25 p.m. Cock came, fed young on ivy berries, and flew away.

1.27 p.m. Hen came, fed young, and flew away.

1.28 p.m. Cock came, fed young, and flew away.

2.40 p.m. The young bird is sitting up on the edge of the nest, and seems quite excited and ready to fly.

2.44 p.m. Cock came, fed young, flew away. The young bird has retired into the nest again.

2.55 p.m. The young bird makes little noises, and has made an excursion about a foot along a branch; it seemed rather

nervous, and, after looking round a little, came back to the nest and made more little noises like a small rattle.

3.2 p.m. Hen came, looked at young one, and flew away.

3.10 p.m. Cock came and fed young one with a quantity of worms, cleaned nest, carrying away the dropping, instead of swallowing it as usual. This they have done several times lately.

3.13 p.m. Cock came, fed young, picked up a small piece of dirt on the side of nest, and flew away with it.

3.15 p.m. Hen came, looked at young, and flew away.

3.18 p.m. Cock came, fed young, and flew away.

3.30 p.m. Hen came, fed young one with ivy berries, and flew away.

I had now to leave.

6.0 p.m. The young bird was still quiet in the nest.

April 19. Early this morning the young bird was sitting on a branch about four yards above the nest; the cock came and fed it with ivy berries. The young one spends much time in cleaning itself and stretching its wings.

11.10 a.m. Young bird still in the same place. Cock fed it with worms, and induced it by persuasive movements of the head to hop to another branch. He then went to the nest and picked out a dropping and carried it away.

11.15 a.m. Cock came, fed young with worms, stayed close to it, seemingly talking a little, then flew away. In about a minute the young one flew away to a large evergreen about 30 yards off; there the cock sat close to it for a little time and then flew away.

12.34 p.m. Cock fed young and flew away. This was repeated at 12.37, 12.52, 12.55, 12.58, and 1.0 p.m. On the two last occasions the food consisted of worms.

3.0 p.m. Young bird still in evergreen, cock still feeding it.

Here I had to leave for the rest of the afternoon.

April 20 and onwards. After this the young birds remained about in the garden, the old ones feeding them.

May 8. The first part of the time after the young had flown they stayed in the trees and shrubs, but now they are beginning

to come down on to the lawn; they seem, however, to have some difficulty in starting to fly from the ground. They and their parents are very noisy all day long in the garden, but they never go far off, only into the nearest parts of the fields, and that not much.

The sharpness of sight in the old birds, as in other wild animals, is most remarkable. They are equally quick at seeing near and distant objects—a magpie or anything else that they do not like in a bush or tree 50 yards off, or the closing of a photographic shutter four yards off, inside the window of the room from which I watched them. This made it very difficult to get satisfactory photographs of them on or near the nest. They did not seem to mind my watching them, and they evidently saw me, as they would watch all my movements, and even generally take my opening and shutting the window quite calmly, especially the cock; but, though we did all we could to hide the camera, keeping the window almost closed and the india-rubber tube attached to the instantaneous shutter under the window sill and behind the curtain, the moment the shutter of the camera moved the hen was gone. We wanted very much to photograph the two old birds sitting one on each side of the nest, the cock feeding the young, as they occasionally did, but this we never succeeded in doing, though we managed to get several good ones showing only one of the birds.

On the Form and Probable History of Saxon Church Architecture.

By W. MILES BARNES.

(Read Feb. 25th, 1902.)

THE visit of the club last year to Britford Church, the interest shown by members in the small Saxon arches on either side at the east end of the nave, the enquiries as to the purpose for which these arches were originally constructed, and the mystery which seems to surround the origin of Saxon architecture and the plan of early Saxon churches, will excuse the endeavour to trace that history to its sources, and to show from examples of early churches elsewhere what was the original plan of such churches as that at Britford, and the purposes for which the side chambers were used.

In tracing the history of Saxon architecture, I shall have to go over much of the same ground as for the chapter on "The origin of Saxon architecture," which I contributed to "The Cathedral

Builders" (1). I will, therefore, make use of some of the material of that article, adding to it or condensing it as may seem expedient.

Wherever the Romans planted colonies, they established collegia. The collegium was a corporation or guild of persons associated in support of a common object; there were colleges of artists, of architects, or builders, and artisans, as well as colleges associated with the administration and government, with religion and law. The collegium consisted of a president (who was styled magister) and members (sodales). That collegia were established in Britain shortly after its conquest by the Romans is certain; there were certainly colleges of artisans, *collegia fabrorum*, in Britain in the reign of Claudius. Under Roman instruction, the Britons reached a high degree of excellence as builders, "so that, when the cities of the Empire of Gaul and the fortresses on the Rhine were destroyed, Constantius Chlorus, A.D. 298, sent to Britain for, and employed, British architects in repairing and re-edifying them." *

But the quality of the work of members of these ancient guilds of builders and artisans in Britain is not left to conjecture; we can judge for ourselves what it was from remains of the Roman Baths at Bath, the Roman and Romano-British remains at Silchester, and in all parts of the country.

At Silchester—Calleva Atrebatum—we have the foundations of the earliest Christian church known in Britain; it was erected in the very centre of the city, close to the forum and not far from the heathen temples which it supplanted, and its plan will help us to understand the plan of Saxon churches of a later age. The church was very small, basilican in form, nearly 30 feet long, and, with its two aisles, 20 feet wide, with an apse at the west

---

(1) "The Cathedral Builders," by Leader Scott. Sampson Low, Marston, and Co.

* *Eumenes Panegyric* V. c 21. "Ex hac Britanniæ facultate victoriæ plurimos quibus illæ provinciæ redundabant accepit artifices."

end and a narthex at the east; the building stood in the midst of a court with the laver in front of the narthex, eleven feet distant from the entrance, and there was a well in the court 40 feet from the apse.

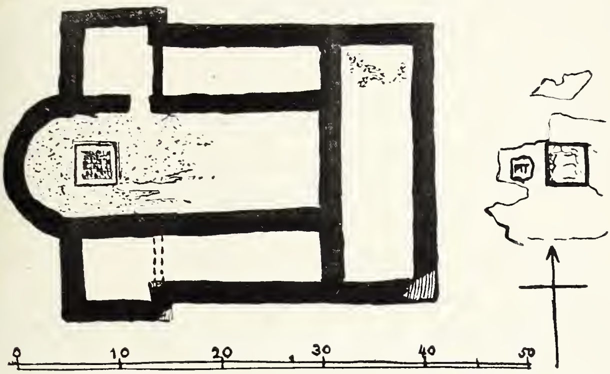


Fig. 1.—Silchester, Plan of small Romano-British Basilican Church.

On each side of the apse was a chamber. The chambers which formerly existed at Britford, and into which the ancient arches opened, were similar to these, but without the aisles.

The small size of the Silchester Church is undoubtedly a puzzle; if a suggestion might be hazarded, I suppose it is possible that this small basilica might be the earliest church, and that it was preserved after it became necessary to build a larger one, if Silchester was not destroyed before that necessity arose.

But there seems to have been a use in early Christian church establishments for a small basilican church even where there was a larger one. In Central Syria the large ecclesiastical establishments at Kalat Sema'n (fifth century), El-Barah and Kherbet-Hass (sixth century) possessed small basilican churches close beside the larger churches. A plan of the ecclesiastical

establishment at Kherbet-Hass is subjoined, showing the small basilica (B) near the larger one (A).

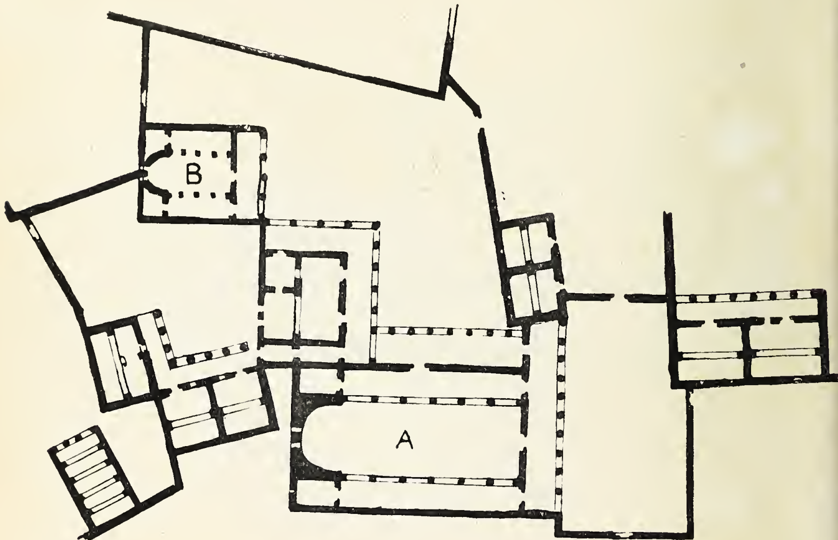


FIG. 2.—Plan of Church Establishment (6th Cent.) at Kherbet-Hâss. Central Syria. *A*. Large Basilican Church. *B*. Small Basilican Church.

The occidental plan of the Silchester church will help to confirm the belief that Christianity came to Britain in primitive times direct from the east and not from the west, if it is a fact, as a well-known Oriental scholar and explorer has stated, that the ancient churches in Syria, and in the east generally, have their apsides at the west end, and churches of the Western Church at the east end. The custom of the British churches as to the time of keeping Easter, &c., points in the same direction, the customs they followed being those of the Eastern, not of the Western Church, and the fact that the church stood in the midst of a court following the Eastern plan, may also be evidence to the same effect.

FIESOLE CATHEDRAL,

SHEWING TRIBUNE EXTENDED INTO THE NAVE.

The Capitals of the Pillars are ancient Roman, evidently taken from the Roman Theatre lately exhumed from the side of the hill on which the Cathedral is built. The writer found a similar Capital amongst the Ruins. The small Capitals, the second on the left and the third on the right, are said to be Etruscan.

A basilica consisted of a nave terminating in an apse, the floor of which was raised. Round the arc of the apse were the seats of the magistrates, the president's seat being in the centre. In front, in the centre of the string of the arc, stood the altar, upon which the witnesses sprinkled a few grains of incense before giving evidence. The naves of basilicas often, perhaps generally had aisles.

From this description it will be readily understood why, when persecution ceased, the Christians should have chosen the plan of the basilica as the most suitable form of building then known for the plan of their churches. The seats of the magistrates round the apse became the seats of the clergy, with the Bishop in the president's throne. The heathen altar was removed to give place to the Christian holy table or altar. These were all the changes that were necessary at first, but, when the services and ritual became more elaborate, it became necessary to enlarge the raised tribune of the apse, which was done by extending it into the nave, the front being protected by railings, *cancellæ*, from whence it obtained the name of chancel,* and a low screen, generally of stone, was built out from it into the nave with a stone pulpit (bema) on either side, from which the Epistle and Gospel were read and the service sung by the canonical singers.†

A very complete screen of the sixth century may still be seen in the Church of San Clemente, Rome; the ancient church from which it was removed is underneath the present building.

---

* In the illustration (Fiesole Cathedral) is shown a chancel extended into the nave to the second bay. Beneath is the confessio, which contains the relics of the saint or martyr to whom the church is dedicated: as it was not the practice to remove the remains of saints and martyrs from the place where they were originally interred before the fourth century, the confessio could not have existed in churches of an earlier date: but, in other respects, Fiesole Cathedral shows the general plan of an early basilican church with cancellæ.

† Conc. Laodic. c. 15.

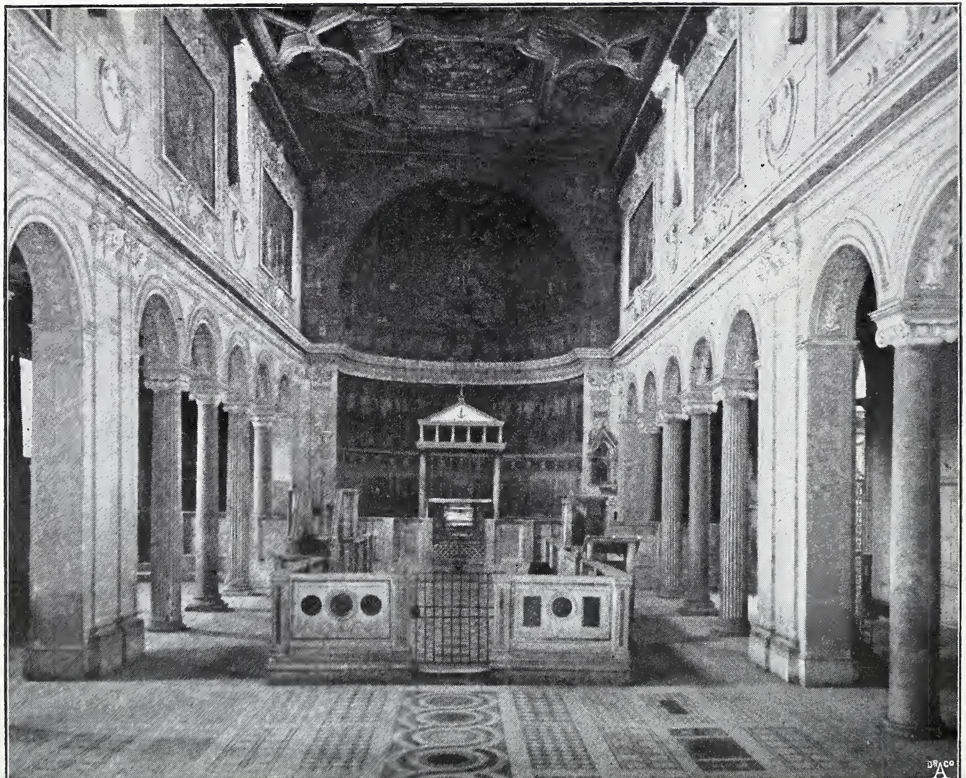
At the end of the church opposite the apse was a narthex, which extended along the whole width of the church, which, with a colonnade outside, often formed one side of the atrium, or open court, which was before the church. In the midst of the atrium was a laver for ablutions. At Silchester, about 11 feet from the narthex, a platform of tiles was found, and it is conjectured that this was the platform for the laver, the pit behind it receiving the overflow of the water. The atrium was a common feature in early churches throughout the Christian world, though more common in the west; in the east the church often stood in the midst of a court, about which were the exedræ (the outbuildings) of the church.

In Britain the atrium was a common adjunct of the church far into Saxon times. In British times it seems to have been used in some churches for the canons, who had cells round it. St. Cadoc, early in the sixth century, built a church in Lancarvan Monastery, which monastery he rebuilt. Each of the thirty-six canons had a residence *in atrio*,* the residence being probably a cell with a door opening into the atrium, such as may still be seen in some old monastic cloisters on the Continent. There is evidence of an atrium at the west end of Brixworth Church, and the construction of the basements of the towers at S. Mary, Deerhurst, at Monkswearmouth, and Barton-on-Humber, seems to show that there were atria attached to those churches.

The need of treasuries and vestries for the use of those who served the churches must have presented itself at a very early date; as soon, in fact, as persecution had ceased and Christians were able to build churches and worship in them openly, without fear of disturbance, for the earliest churches of which there are any vestiges possessed them, and Paulinus, as early as the end of the fourth century, mentions them and describes their

---

* Passio S. Cadoci.



SAN CLEMENTE, ROME.

position and uses.* Besides the greater treasury and offices, which were not within the church, but were in the group of church buildings which surrounded it, there were two chambers, the prothesis and the diaconicon, one on each side of the apse. In the former oblations were received, and preparations made, for the Eucharist; the other chamber was a vestry, and to it the clergy retired to make the concluding prayers in private after the service.

Possibly the need of such accommodation influenced the early Christians in the choice of the model for their churches, for the church at Silchester and some other early churches are not unlike in plan to the Ulpian Basilica in Trajan's Forum at Rome —at least, in respect of the chambers on either side of the apse. (See plans, Fig. 5.)

The testimony of the succeeding age to the plan of early Christian churches is to the same effect. In Syria Christianity flourished from the decay of the Roman power until the Muhammadan invasion swept over the land early in the seventh century, desolating it and depopulating it of its Christian inhabitants; but, though the congregations were swept away, the churches remained, and remain to this day; roofless certainly, but the walls, for the most part, standing and, in plan, unchanged, for decay is slow in those eastern lands. The evidence of these churches is from this fact very valuable.

In Syria there are churches which date from the fourth, fifth, and sixth centuries, and the plans of some of these churches I have taken from Count de Vogüé's fine work, "Syrie Centrale Architecture Civile et religieuse du I au VII^{e} Siécle," to compare with the Basilican churches of Roman and Saxon times. They form a link between them, showing that the Saxon conformed to the model generally adopted for churches in the east and west, with such small and gradual changes as might have been expected to take place in the course of centuries.

---

* Paulinus Ep. 12, ad Sever., p. 154.

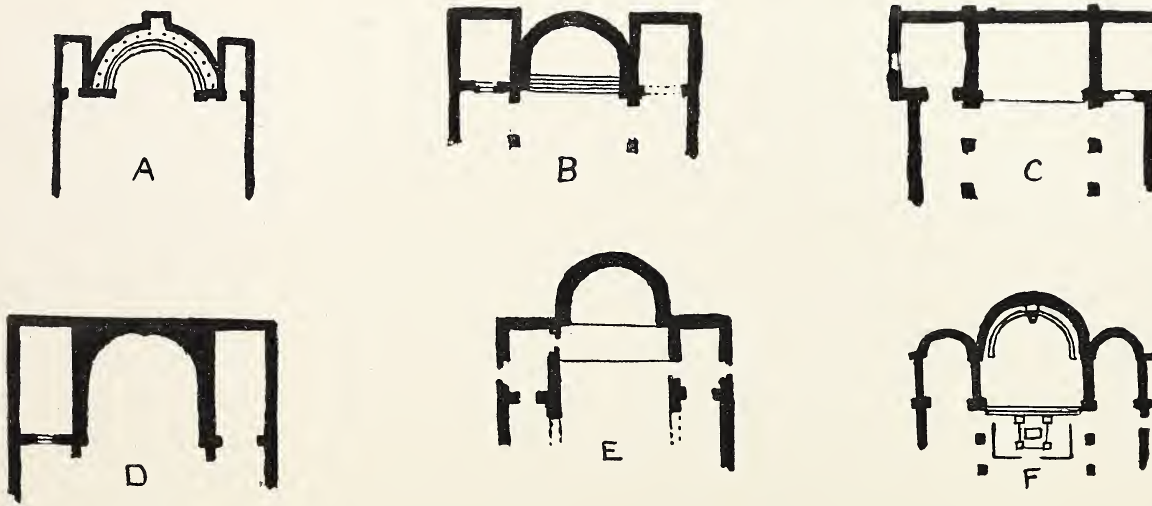


FIG. 5.—*A*. Plan of Tribune of Ulpian Basilica in Trajans Forum, Rome, with side Chambers. *B.-F.* PLANS OF TRIBUNES OF EARLY CHURCHES WITH SACRISTIES. *B.* Baquoza, Syria, 6th Cent. (the Church of S. Praxedis, Rome, is similar in plan). *C.* Kherbet Hâss, Central Syria. *D.* Roueiha, Central Syria (6th Cent.). (The Plans of S. Maria of Grado, Italy, Moudjeleia, and Deir-Seta, Central Syria, all 6th Cent., are similar in plan.) *E.* Qualb Louzeh, Central Syria (6th Cent.). *F.* S. Ambroise, Milan, as it was in the 9th Century.

From these examples it will be seen that the chambers to the right and left of the apse were the chambers mentioned by Paulinus, the use of which in the east was continuous down to the very time that Syria was desolated by the Muhammadan invader, for the doorways in them are such as might be required from the descriptions given by Paulinus, and they would not have been required had the chambers been intended for other purposes.

It seems impossible also to resist the inference that the small arches at Britford were originally doorways to such chambers,

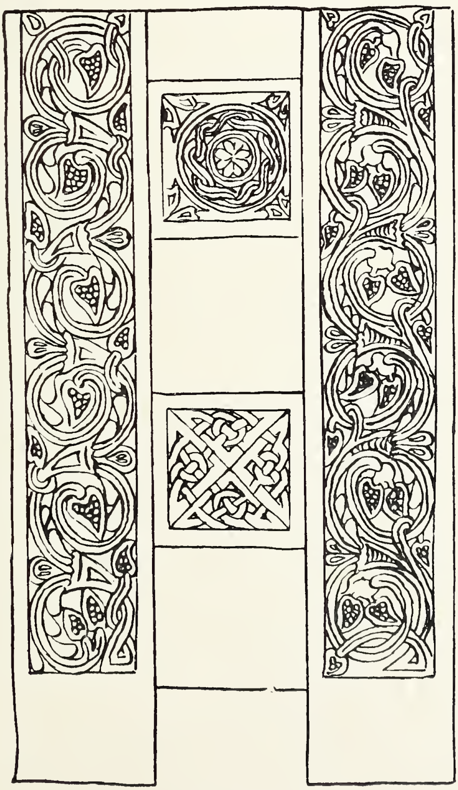


Fig. 6.—Saxon Ornament on an Arch in Britford Church.

which were closed by doors or hangings, the former, if in the opinion of experts the indications on the untouched arch are such as would be consistent with the use of doors swinging within them. The archway on the north side (Fig. 6) has evidently been mutilated, probably at some mediæval restoration of the church, when—as I ventured to suggest last year—the early stone ambons and screen were done away, and their carved pilasters and details were used for the decoration of the arch on the north side, and the chambers were perhaps then converted into side chapels. The church at Breamore seems to have been built originally at a later date than Britford, when the chambers, as in late Saxon churches, were moved down from the sides of the apse, and gave a cruciform plan to the church, and were possibly used at a later date as side chapels or mortuary chapels (the latter a common use for such chambers in Saxon times).

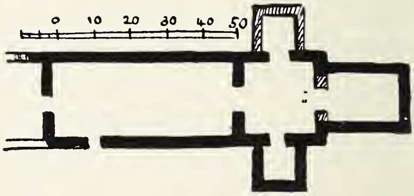


Fig. 7.—Breamore, Plan of Church.

It is a common and mistaken idea that the termination of nave and aisles and chambers were always apsidal in early Christian and Saxon churches. Plans of early churches in Syria, Italy, and elsewhere show us that the ends were sometimes square, or the wall square externally, and hollowed out into an apse within, or the nave possessed an apsidal chancel, whilst the chambers were square-ended. (Fig. 5, page 95.)

But in general plan churches, whether in Asia, Italy, or Britain were alike; and in general architectural effect and ornament, so far as can now be judged, and with some deviations, due to local influences, they also corresponded.

There seems no perfectly satisfactory way of accounting for the universal correspondence of church architecture over the whole Christian world, otherwise than that the building operations were directed by men who were associated in guilds, and

who executed their work in accordance with the traditions of those guilds.

That the church at Silchester accorded with those built in the same age in other parts of the Roman Empire is intelligible enough, if we accept the proposition that they were all built by members of Roman Collegia. So far all is plain, but, with the fall of the Roman Empire, the Roman Collegia generally came to an end. How are we to account for the correspondence in architecture in distant parts of the world after that event? Was the work of the old guilds still carried on, and in what way?

That collegia of artisans were established in Britain early in the Roman occupation we have already seen; that they were continued by the Romano-British after the departure of the Romans seems probable enough. But, when Britain itself was overrun by barbarians, and Roman civilisation was almost stamped out, is it possible that the collegia could have survived, and, if they did for a time survive, must they not soon have collapsed through lack of motive for continued existence?

Mr. Coote affirms that they continued to exist after the final departure of the Romans from the island, and that the Saxons found them here and did not interfere with them. If it is a fact that colleges of workmen and builders founded during the Roman occupation were in existence after the Saxon invasion, it needs explanation why the earliest missionaries to the Saxons had to bring or to send abroad for workmen to build churches.

On the Continent the barbarians who overran Italy dreaded the influence of the collegia and vigorously suppressed them, prohibiting them everywhere under the hardest penalties. Under such circumstances we can understand that the societies in Rome could scarcely escape observation, and we shall be prepared to hear that the college of architects and builders in that city removed from thence and took refuge elsewhere. According to tradition, they settled at or near Comum, where in mediæval times, under the title of Comacine Masters, they gained fame as architects, and their services were in much request

throughout the Continent and beyond it. Had the barbarians, however, treated the Roman colleges with the same indifference as the Saxons are reputed to have shown towards them in Britain, all guilds of artists and artisans must, for a time at least, have ceased to exist, or they must have removed from Rome, where there was no longer any appreciation of art or demand for their services.

It is true there is no documentary evidence to prove the continuous existence of the *Collegia* from Roman to mediæval times, or to show that the Roman college which removed to Comum was identical with the Comacine Guild, which emerged from the darkness which shrouds the history of those early times; there is, however, such evidence as can be derived from the similarity of the institutions in their aims and constitutions. In the latter institution even the title of *Magister* was retained. Though the use of the term was no longer limited to the president of the body, every competent and fully-instructed member of the society was admitted to the order of *Magistri*—so called possibly because these members formed the governing body—and the president became a *Grand Master*. The members generally were called *Liberi Muratori* (Freemasons)* because they were not subject to the sumptuary and other laws which regulated the work and pay of ordinary workmen.

Comum, which possessed all the privileges of a Roman *Municipium*, stood at the head of Lacus Larii—the lake of Como—on the northern shores of which, from Como to the Island of Comacina, P. Strabo and C. Scipio settled Greek colonies, which Julius Cæsar added to and consolidated. The names of villages on these shores of the lake are still some guide to its extent and limits. Comum was made the seat of the colony.

After the fall of the Empire, this Romano-Greek colony seems to have withstood the attacks of the barbarians and preserved its independence for a long time. At the time of the invasion of

---

* See Chapter I., Merzario, *I Maestri Comacini.*

Italy by the Longobards the whole of the northern end of the lake was in the hands of the imperial (Byzantine) party, and it was not until the year 586 that the Island of Comacina fell into the hands of the Longobard King, Autharis, though the lake and country northwards of the island seem to have still continued under imperial rule. The country round Comum, therefore, remained in comparative quiet, and, if much progress in art was not possible, there, at least, it did not become altogether degenerate.

The Greek influence was evidently strong in the colony. Even the Bishop in the latter end of the fifth century was a Greek, for S. Abbondio, who died Bishop of Comum in 489, had previously held the Bishopric of Thessalonica. Possibly other bishops of that diocese were of the same nationality. It would be surprising if the Roman Architectural College, which took refuge there, had been altogether unaffected by it, particularly as the Romans derived their knowledge of architecture, as well as of art, from the Greeks; and Greek architecture was at all times treated by the great Roman architects with respect, as we learn from Vitruvius; besides, with the fall of the empire, all progress in Roman art had ceased, and Byzantium was the quarter to which men looked for instruction in Christian and secular art.

Müller says, after the fall of Rome, Constantinople was regarded as the centre of mechanical and artistic skill, and a knowledge of art radiated from it to distant countries.*

Let us turn our attention now to Britain and enquire how the Comacine Guild could have influenced the building of churches in Britain.

---

* "According to Müller (Archæologie der Kunst) corporations of builders of Grecian birth were allowed to settle in foreign countries and to exercise a judicial government among themselves according to the laws of the country to which they owed allegiance; the principle was recognised by all the legal codes of Europe, from the fall of Rome to late in the thirteenth century. Such associations of builders were introduced into Southern Europe during the reign of Theodoric and Theodosius."

The Italian historians relate that Pope Gregory, in A.D. 598, sent over the monk Augustine to convert the British, and with him several of the fraternity of *Liberi muratores* (Freemasons), so that the converts might speedily be provided with churches, oratories, and monasteries; also that Augustine, in 604, despatched the priest Lorenzo and the monk Pietro back to Rome with a letter to Pope Gregory, begging him to send more architects and workmen, which he did.* We shall see presently that, although Bede does not say in so many words that Augustine was accompanied by architects and builders, yet that is the inference which Pope Gregory's instructions to Mellitus conveys.

It was a common practice in mediæval times for missionaries, whether bishops or monks, to have in their train builders and stone-cutters, and they themselves were often skilful architects. St. Hugh of Lincoln was not the only bishop who could plan a church and handle a hod.†

Even female saints appear to have included in their retinue persons who were capable of building churches, though the followers of St. Modwen,‡ who, on landing in England from Ireland about A.D. 500, left her attendants to erect a church at Streneshalen, near the Arderne Forest, while she went to visit the King, may have been only capable of building in wattle work or in wood; § still, it is one instance out of many of the prevalence of the custom for missionaries, whether priests, nuns, or monks, to take in their train on their missionary expeditions workmen experienced in building, and to employ them where necessary to build churches for their converts.

---

* Maestri Comacini, by Prof. Merzario, Vol. I., cap. ii.

† "Vita Sancti Hugonis Episcopi Lincolniensis."

‡ "Vita S. Moduennæ Virginis Hibernicæ."

§ Bede (iii. 25.) describes the church of Lindisfarne as built after the manner of the Scots, not of stone, but of hewn oak covered with reed. Eadbert, Bishop of Lindisfarne, afterwards stript off the thatch and covered the church, walls, and roof with lead.

According to Bede (iii. 4.), the Britons likewise rarely built of stone.

Professor Merzario states, on the authority of ancient MSS., that the architects and builders sent were *liberi muratori*. Now, the members of the Comacine Guilds were known, and were described in ancient MSS. under that title; besides, what other guild would Gregory be likely to invite to send members to join the mission? Were there, indeed, any other building guilds existing at that time, except the Byzantine societies? It is certainly not probable that Gregory would have invited Greek *etairia* to send members with the Roman mission to build churches "after the Roman manner," which is what the first builders in Saxon England did, and in preference to builders belonging to a society which was of Roman origin, and held all the traditions of the Roman School of Architecture.

But, without the record of Italian chroniclists, it would have been clear to any careful reader that architects accompanied Augustine and other early, as well as late, missionaries to England. The first evidence will be found in Bede (I., 26), where it is stated that, after King Ethelbert had been converted to the faith, the missionaries built churches and repaired old Romano-British churches in places whither they came for their converts to worship in.

And, again (I., 30), Gregory instructs Mellitus not to destroy idol temples, but, if well built, to cleanse them and put altars in them, and convert them into churches. Gregory states that he decided on this course after mature deliberation, which seems to show that Gregory knew that many of the old Roman temples were still in existence, and that Mellitus had with him architects who were qualified to carry out the necessary repairs to them.

Again, in 601, Pope Gregory sent Paulinus and others to assist Augustine in his work, and by them he sent sacred vessels, ornaments for the church, and vestments. Now experienced architects to build churches for the converts were as necessary as the ornaments wherewith to furnish them, and it is fair to conclude that this essential had not been overlooked, and that there were with those who brought the ornaments men competent to erect the churches to place them in. Indeed, it

seems possible that Paulinus himself may have graduated in the Comacine School of Architecture ; it is a significant fact that he is spoken of under the title of *Magister** the title given to fully-instructed members of that order, and we know that monks were amongst the enrolled members of the Comacine body.

The strongest evidence, of course, would be the evidence of his work as a builder. Unfortunately, little of that remains, though the little we know about it is consistent with the fact that either he was of that order, or he had Comacine masters with him. The Whalley Cross, which is attributed to him, is ornamented with that peculiar convoluted ornament which is found in early Comacine work, and he was certainly a builder of churches of the type which the Comacines would have built at that time. Bede relates that he built in Lincoln a stone church of beautiful workmanship, in which he consecrated Honorius, Bishop of Canterbury, in the place of Justus. The "beautiful workmanship" implies an experienced architect. Bede, who thus describes it, was a competent witness, and in all probability he knew the church, which he describes as roofless at the time he wrote.

Again, King Edwin, under the direction of Paulinus, built a "large and noble church of stone" at York (II., 14). At this time the Comacine builders had not begun to build in the style, which was afterwards known as the Lombard or Romanesque, and this church seems to have been an Italian Basilican Church with an atrium in front of it before the entrance, as was customary in churches of the period, this particular atrium being built round the little wooden oratory which Edwin had put up before his baptism when under the instruction of the Bishop, the oratory being in the midst of the open court.

Wherever the Comacines established themselves, they founded lodges ; to each lodge a *schola* and a *laborerium* were attached, where the members received instruction and training in the several branches of their craft. The Comacines who settled

* Montalembert I Monaci dell' Occidente, p. 152.

with Augustine in the royal City of Canterbury seem to have established a lodge and a *schola* in that City, for there Wilfrid, some seventy yeary later, sent for architects and builders (cæmentarii) to renew the cathedral church of York which had been built by Paulinus, but, possibly through increase of population, was now inadequate. The plan of the ancient church has been traced ; it was Basilican in form, with aisles and an apse.

Wilfrid, for forty-three years Bishop of York, was, while still a young man, sent to Rome as a companion to Biscop, a Saxon thane who was afterwards Abbot of Wearmouth and Jarrow. There, says Bede, he spent some months in the study of ecclesiastical matters. On his way home he remained in Gaul for three years. When he returned to Britain at the expiration of that time, King Alfred gave him land and the monastery of Ripon, where he built a spacious church, which excited universal astonishment and admiration ; though not so large as the church he afterwards built at Hexham, it was a noble building. The apse with its altar was at the west end, and underneath the apse was a *confessio,* which with its passages still exists. The round-headed arches within the church were supported by lofty columns of polished stone.

But, beautiful as this church was, *that* at Hexham surpassed it. Eddius Stephanus, precentor of York, the biographer of Wilfrid, and Richard of Hexham give enthusiastic descriptions of it, which accord with what we know the Comacine Church of the period to have been.

From them we learn that St. Andrew's, Hexham, built by Wilfrid, was a Basilican church, with an apse and crypt (*confessio*); the crypt and its passages are still in existence. The proportions of the church were, however, nobler and the details richer. The walls were covered with square stones of divers colours and polished.* The columns were also of polished stone; the capitals of the columns, arches, and vault of the apse, and space over the apse-arch were adorned with sculptures and

* Evidently *Opus sectile.*

histories (*i.e.*, with paintings representing sacred scenes), all very splendid and very beautiful, according to Eddius. The Comacines were much given to colour in the decoration of their churches. It was in one of them, that of S. Maria del Tiglio, built by Theodolinda, wife of King Autharis, that the Emperor Lothaire beheld a brilliantly-painted picture, which adorned the vault of the apse, and represented "The three kings presenting gifts to the Child Jesus." The picture moved the king to undertake the restoration of the church.

The Comacines also used frescoes in Theodolinda's palace at Monza in the fifth and sixth centuries.

From the description of Hexham Church by Eddius Stephanus it would appear that there were galleries over the aisles, to which access was gained by spiral stairways in the wall. Similar galleries with a spiral stairway still exist in the Church of S. Agnese in Rome. In this church, between the nave and the aisles, there is a double arcade of open arches one above the other; the higher arcade on each side forms the front of the galleries; above these is the clerestory. The Church of S. Lorenzo at Verona, also a Comacine church, contains in the wall a spiral stairway, which led to the different divisions in the women's gallery for the widows, matrons, and girls.* So far, I have not heard of any ancient spiral stairways as still existing in any other than in these Comacine churches.

The galleries and arcades may be regarded as the original of the triforium.

Eddius relates that there were also bell towers at Hexham of surprising height, and this is suggestive. Hexham was built about A.D. 674, early in the Saxon period, and these tall towers were built wholly at that time. What were they like? The early Comacine towers were built in several stages; the lowest generally had either no windows or else merely slits; the stage next above it had single-light windows, plain, round-headed, and straight-sided, as if cut out of the wall; in the stages above, the

* See Bingham's Antiquities of the Church.

windows were of two or three lights divided by colonnettes, the larger number of lights being in the windows of the upper stages; in each stage there were commonly four windows, one opening to each quarter of the compass. Wolstan's description of the tower of Winchester answers very closely to this. He said it consisted of five storeys; in each were four windows looking towards the four cardinal points, which windows were illuminated every night.

As examples of early Latin towers, the round towers of S. Appollinare Nuovo and S. Apollinare in Classe, Ravenna, and perhaps the square tower of S. Giovanni Evangelista, Milan, may be given. Take any one of them, that of S. Appollinare Nuovo, for instance. Cover the upper stages and regard only the lower stages with the single-light windows, and you have a structure which might be Roman. The lower stages look very much older than the upper stages; and it is the same with well-known Saxon towers in England, so that some persons have been misled into thinking that the lowest stages with straight-cut, single-light windows are of much earlier date than the upper portions with double or treble light windows, and they have argued that these lower stages, both in Italy and England, are older than the upper ones, notwithstanding the improbability that the builders would place a heavy tower on walls originally intended to carry only a light roof.

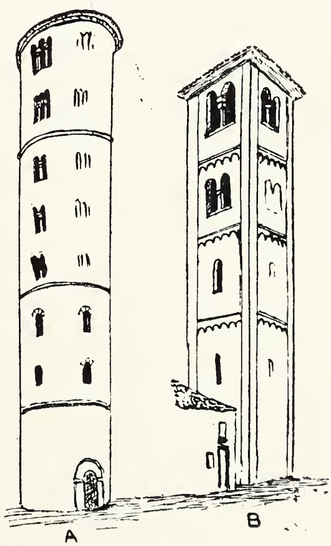


FIG. 8.—*A*. Tower of S. Apollinare Nuovo, Ravenna.
B. Tower of S. Satyrus, Milan.

The Saxon towers have clearly a Latin or Comacine origin. The walls are usually of stone grouted in the old Roman manner, and, when Lombard windows of two or more lights, with columns dividing them, are used, they are, as a rule, in the upper and not in the lower stages. Unfortunately, we have no towers of the earliest Saxon period still standing; but the resemblance between the later Saxon and the early Italian towers will be apparent to any observer. The same may be said of the later Comacine towers, S. Satyrus, Milan, for instance (see Fig. 8), which Cattaneo assigns to the ninth century and regards as the prototype of Lombard towers. Take away the little pensile arch ornament, which was characteristic of the Comacine style known as Lombard, and you have a tower which might be Saxon.

Whilst Wilfrid was engaged in building Hexham, his friend and companion in travel, Biscop, was building the monastery and monastic church of Wearmouth. Biscop was a Saxon thane of Northumberland; he became a monk of the monastery of S. Lerino, and, according to Henry of Huntingdon, on his return from Rome, King Egfrid gave him sixty hides of land, on which he built the monastery of Wearmouth. Eight years later the King granted him more land at Jarrow, upon which he built a monastery and church. The former was dedicated to S. Peter, the latter to S. Paul. On obtaining possession of the lands at Wearmouth, Biscop, according to Bede,* set out for Gaul to find builders to build the monastic church, "juxta Romanorum quem semper amabat morem."

It might be asked "If there was at Canterbury a Comacine school of architecture, whose special function it was to build on the Roman model, why did not Bishop Benedict send there for architects and masons?" The simple answer is that Wilfrid had already engaged them for his work at Hexham. Wilfrid was building both a church and monastery there, and evidently had employment for every hand he could obtain.

* Sermo beati Bedæ in natale sancti Benedicti Abbatis.

The building of Hexham was commenced in 674, and it was not till that date that Biscop was in a position to engage workmen for Wearmouth, so that Wilfrid was just beforehand with Biscop, who in consequence had to look elsewhere for his architects, and he set out for Gaul to engage them there.

Now, it does not at all follow that, because Biscop brought his masons from Gaul, they were not Comacines; the inference would rather be the other way, because Lombardy, the home of the Comacines, was at that time a part of Gaul. Biscop insisted on a church built after the Roman manner; a Basilica he would have, and nothing else, and no builders could build a Basilica better than the successors to the Roman College of Architecture. They also seem to have followed the practice of the Comacines in establishing a *schola* at Wearmouth, possibly amongst the monks, for Naitan, King of the Picts, sent to Cedfrid, who succeeded Benedict as Abbot, and begged him to send architects to him to build a church in his nation "*after the Roman manner*," and the Abbot complied with his request.

Mr. Micklethwaite states that "the doorway under the tower of the church at Monkswearmouth in Durham was doubtless a part of the church which Benedict Biscop erected there in the seventh century in imitation of the Basilicas in Rome. The twined serpents with birds' beaks on the right door-post are, as we know from MSS. of that age, singularly characteristic of the style." There is a similar carving on the architrave of an ancient door in San Clemente, Rome.

The decoration of the church seems to have been in the highest style of Comacine art. Even glass-makers were brought from Gaul to make glass for glazing the windows of the church. No glass had ever before in Saxon times been used in England for windows, and even paintings were brought from abroad for the decoration of the walls. Bede, in his sermon on the anniversary of the death of Benedict, states that he imported paintings of holy histories, which should serve not only for the beautification of the church, but for the instruction of those who looked upon them. Vases, vestments, and other things

necessary for the service of the church were also brought from Gaul, and those things which could not be obtained there were brought "from the country of the Romans."

The church was pronounced by monkish writers to be for two centuries the grandest and most beautiful church on this side of the Alps. Even Roman architects admitted that they who saw Hexham Church might imagine themselves amidst Roman surroundings. ("Ambitionem romanam se imaginari jurent"—Malmesbury, De Gest. Pontiff. I., iii., f. 155.)

Though we have little ornament of the early Saxon period, the little we have is clearly of the same character as the Comacine, and, like the Comacine, shows distinct evidence of its original derivation from the Roman.

Roman Mosaic pavements found in England are mainly composed of geometric designs sometimes foliated and floriated, figures being only sparingly and occasionally introduced. At what date they were laid down may be inferred with some degree of probability from the coins found with them.

Morgan* states that, with few exceptions, the coins discovered on the sites of Mosaic pavements in Britain belong almost entirely to a date extending from the reign of Gordianus III., or say Alexander Severus, to that of Arcadius—a period of about 175 years. That would give a date to British pavements of late third and fourth centuries. Much ornament of very late Roman work is, therefore, preserved to us in these pavements. If the patterns are analysed and resolved into their component parts, they will be found to consist of a limited number of elementary designs arranged in varied combinations, and most of these separate designs can be traced backward to earlier Roman, some to still earlier Greek, and a few to very ancient Oriental sources.

When they were first introduced as decorative features into Roman architecture there is little to show. Some of the patterns, as Fig. 9, B. H. J. M. N. are to be found on Pompeian

* Romano-British Mosaic Pavements.

pavements, so that these at least were in use previous to A.D. 60, and, as I have only examined the plans and originals of a very few Pompeian pavements out of the hundreds that must have been uncovered, it is not improbable that more, perhaps most, of the ornament on Romano-British pavements, may have been used in Roman pavements of the earlier date; and, as these designs with their derivatives constitute almost the only ornament on Saxon crosses, it is apparent that the Saxon could not have borrowed them from the Celts and Scandinavians, as it is sometimes affirmed they did, since they are found in Britain at an earlier date than in Scandinavia and in Italy earlier still. They could have obtained them only through the successors to Roman School of Architecture.

I give in outline the principal of the designs which I have noticed both on Romano-British pavements and on Saxon crosses with a few remarks, noting where elsewhere they have been seen.

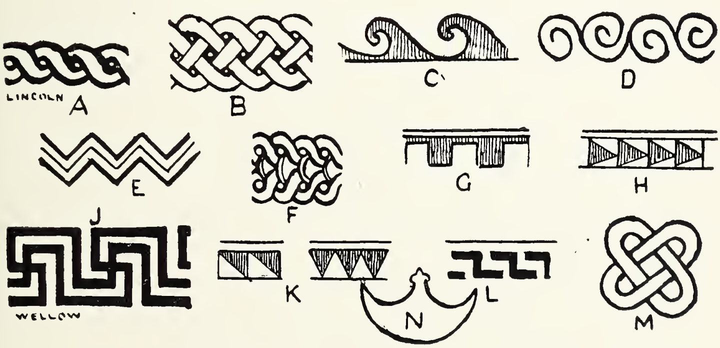


Fig. 9.—Details of Ornament found on late Roman, Romano-British Pavements, in Comacine Decoration, and on Saxon Crosses.

Ornament Found in late Romano-British Pavements, in Comacine Decoration, and on Saxon Crosses.

A. *The Guilloche.* The commonest of all ornaments. It occurs in most of the Roman pavements in England, in one of the third century at Halicarnassus, and in one of the fourth century at Carthage.

It is a common Greek ornament of an earlier date. It was found at Nineveh painted on a fragment of burnt clay.

B. Found on Roman Mosaic at Carthage (fourth century) on pavements at Pompeii; on the Attic base of a column in the temple of Minerva Polias at Athens; on a large hæmatite seal of the "type known as Hittite or Asianic in Northern Syria." An extension of the design gives the familiar basket-work pattern, which may be seen in panels of the Roman pavement in the floor of the Dorset Museum, in Comacine panel (sixth century) in the church of San Clemente, Rome (Fig. 13), and on various Saxon crosses.

C. Common scroll enrichment in Greek architecture, also Pompeian.

D. One of the ornaments on the fragment of a pillar from the treasure house of Atreus at Mycenæ, which is said to be of the Homeric Age. Common as a later Greek ornament.

E. Silver gilt fibula, ascribed by Stevens to fifth or sixth century, found in Norway. Mosaic, Carthage, fourth century. Palace of Diocletian, fourth century. On a wall mosaic, at Nineveh.

F. Frequently occurs as an ornament on the tori of the base or soffits of the architraves of ancient Greek buildings.

G. *Dentils.* Of common occurrence on the entablature of Greek buildings; on pavement of a Roman house in Utica; on rock tombs of Darius in Persepolis of Zanthus and of Antiphellus.

H. Mosaic at Carthage (fourth century). Pavement at Pompeii.

J. *The fylfot or swastica*, one of the commonest of Greek ornaments, found on many terra cotta objects dug up by Dr. Schliemann at Troy dating 1000 to 1500 B.C., occurs in many, and some elaborate forms in Greek architecture, and seems to have been adopted from them by the Romans. It has been observed painted on an Egyptian tomb ceiling.

K. Roman pavement found at Halicarnassus, third century.

I. Roman pavement at Utica, fourth century; on Fibula, fifth or sixth century, said to be Norwegian (Stephens).

M. Pavement at Pompeii.

N. Pavement in Pompeii. This ornament has been called the Axe of Lycurgus.

There are striking ornaments on Saxon crosses, of which the simple forms are given above (Fig. 9), but which are foliated and floriated. The evolution of these from the original simple forms may be followed in the examples beneath:—

DOORWAY OF THE CHURCH OF S. MARCELLO AT CAPUA
(4th Cent.)

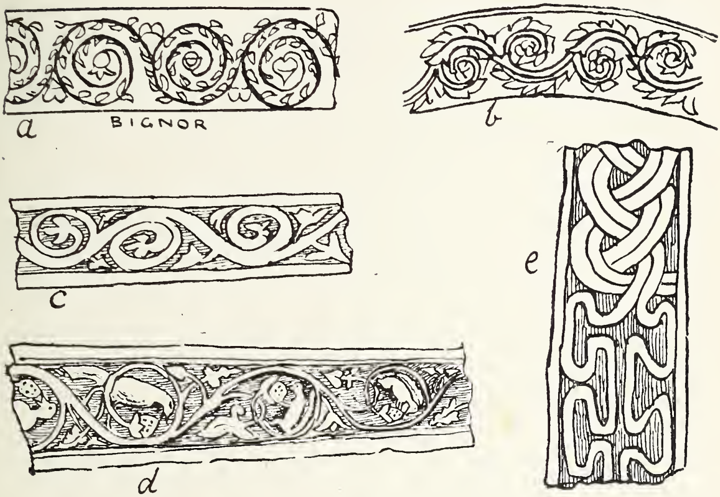


FIG. 10.—*a, b, c, d,* Vitruvian Scroll elaboration.
e, Sculpture on the Penmon Cross, showing that the Saxons understood the principle of Intrecci Designs.

Vitruvian scroll, Roman, original motif (Fig. 9 D).

Roman elaboration. Roman pavement found at Bignor (Fig. 10 a) and on other Roman pavements and sculptures.

Late Roman elaboration. Decoration (fourth century) of the Church of S. Januarius in the Catacomb of Prœtextatus, illustrated in "Christian Art and Archæology" by Walter Lawrie, p. 76. The vault of the church is decorated with this scroll foliated and floriated, with birds in the branches.

Saxon elaboration. Collingham Cross (A.D. cir. 651) (Fig. 10 c), and Bewcastle Cross (Fig. 10 d), the scroll foliated and floriated with birds and beasts in the branches. Compare this with similar ornament on the Ruthwell Cross and both with the scroll on the left jamb of the doorway of the Church of S. Marcello at Capua, of the fourth century, illustrated in Fig. 11., and note that the Roman ornament is earlier than the Saxon.

Again, compare the Vitruvian scroll (Fig. 10 b) from the Roman pavement found at Woodchester with the scrolls figured on the soffits of the Saxon arch at Britford (Fig. 6), and it will be seen that this so-called Saxon ornament is clearly derived from Roman sources, and the presence of Comacine masons with the early missionaries and the establishment of Masonic scholæ would account for the introduction of Roman designs.

It has been thought that, because some of the crosses bear Runic inscriptions, therefore, they are wholly the work of Scandinavian stone-cutters, and the designs are also Scandinavian. The Kirkdale, Bewcastle, Ruthwell, Crowle, Yarm, and Collingham Crosses all bear Runic inscriptions, but, on inspection, it will be seen that these inscriptions are generally by another hand and of ruder workmanship than the carving of the crosses. Sometimes they are little better than scratches. On the Kirkdale and Lancaster Crosses the runes are certainly inferior in workmanship, and they seem to have been an after thought; the borders on which they are cut do not appear as if they were originally intended to bear them.

On the Yarm Cross a panel was evidently left by the carver for the inscription which was afterwards cut upon it, but, being too small, the last two lines had to be compressed to be got into the space. On one cross two panels were left for inscriptions; one remains blank to this day. Did the Masonic guild design and work crosses in their laboreria and so keep the members of their guild employed, and supply them when asked for with blank panels for the inscriptions to be inserted by local stone-cutters?

It must not be supposed that the Masonic scholæ established in all parts of Europe never added to or varied from the old Roman designs which they had inherited; there were, doubtless, changes slowly introduced by the Masons in each country, which in time gave a national type to the architecture of that country, and just as in later times the Comacine style in Italy developed into the Lombard and became the national style of Italy; and the Decorated style of Gothic architecture developed into the Perpendicular and became the national style of

England—and of no other country, for it developed into the Flamboyant on the Continent—so the natural bent of mind of the Saxon and Celtic members of the Masonic guilds gave direction to their expression of Romano-Comacine ornament, which resulted ultimately in some approach to a national style. Most divergencies from the Roman model are to be accounted for in this way. Often the elaboration of the original motif was commenced by the Romans themselves and carried on by their successors as in the following examples:—

Fig. 12.—The Evolution of the Saxon Spiral from the Roman Axe-Head Ornament. *(a)* From a Roman Pavement at Wellow. *(b)* From a Roman Mosaic Pavement found in Leadenhall Street, London, now in the British Museum. *(c)* From a Bronze in the Royal Irish Museum. *(d)* From a Sculptured Stone at Park House, Drumoak. *(e)* From a Sculptured Stone, Castle of Strathmartine. *(f)* From a Cross at Hilton of Cadboll.

Fig. 12 (a) is the so-called axe of Lycurgus in its simplest form, as represented on the Roman pavement at Wellow; (b) with scrolled ends, as represented on the Roman pavement found in Leadenhall Street, London, and now in the British

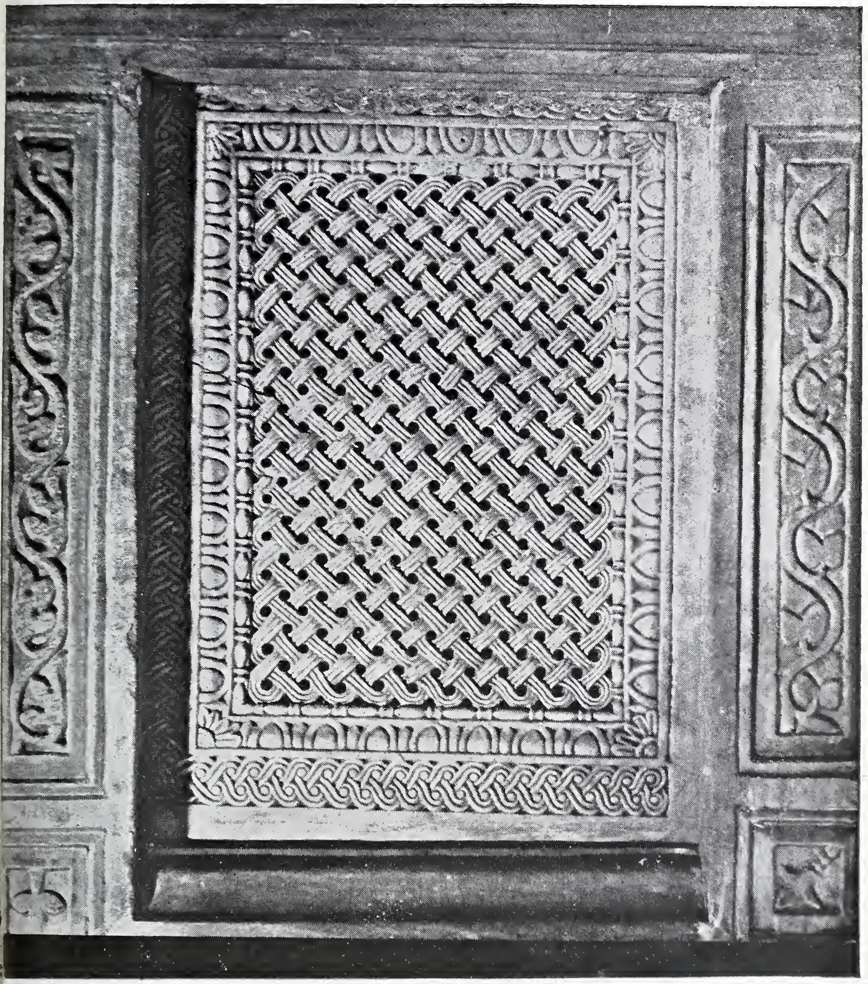
Museum; (d) is the Saxon or Celtic representation of it in its simplest form from a sculptured stone at Park House, Drumoak, Aberdeen; (e) the same with scrolled ends from a sculptured stone at the Castle of Strathmartine.

Arrange two or more of the scrolled axe-heads (b) so that the scrolls shall inter-roll, and you have the spiral ornament, which is thought to be peculiarly characteristic of the early work of the art of this island, and the so-called trumpet ornament is the remains of the axe-head itself extended; (f) shows three out of five axe-heads, from a cross at Hilton of Cadboll, with scrolls inter-rolling and forming Saxon spirals.

It seems clear, therefore, that this spiral ornament is derived from the familiar Roman axe-head pattern, elaborated either in the scriptorium of the monks or in the scholæ and laboreria of the early Masonic guilds; probably in this case in the former, if —as Professor Westwood affirms—the spiral is not found in early MSS. later than the ninth century.

Those who would pursue the matter further should examine the *fac simile* of a page from the book of Durrow in the second volume of "The Sculptured Stones of Scotland," which shows the ornament in its more elaborate form; together with the enamelled ornament on a bronze bowl of Sir P. H. Dyke, in which are three axe-heads with inter-rolling scrolls and an ornament with four ditto from the golden gospels of Stockholm, and a single spiral from the MS. in the Library of S. Gall and in the gospels of Lindisfarne, all of which will be found in "Facsimiles of the Miniatures and Ornaments of Anglo-Saxon and Irish MSS."

A striking example of the correspondence between Saxon and Comacine ornaments may be seen on the Padstone Cross, which is ornamented with the basket-work pattern common in Comacine work, with a strip of the same design as that which decorates the pilaster on the right side of the panel of the stone screen (sixth century) in the Church of San Clemente, Rome, and which is shown on Fig. 13. In short, all the ornaments exhibited in this illustration are to be found on Saxon Crosses, the



PANEL (6th Cent.) IN THE CHURCH OF SAN CLEMENTE, ROME.

basket work on the panel, the ornament on both pilasters, as well as the double guilloche of the border ; and it should be noted that the Italian is the earlier.

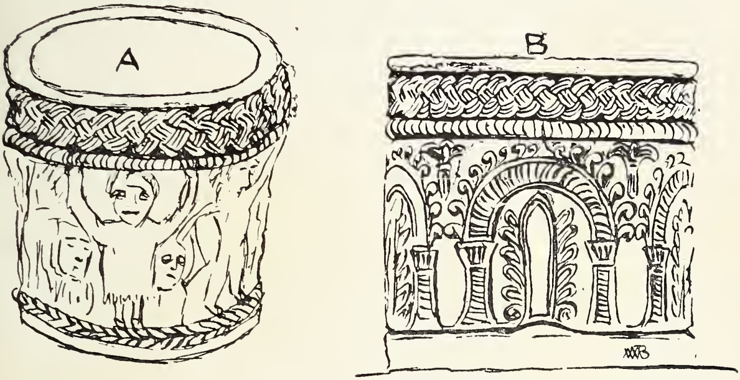


FIG. 14.—*A*. Font, Toller Fratrum, Dorset.
B. Well Head (8th Cent.), Rome.

An instance of the similarity of ornament in early Italian and Saxon carving will be found in comparing the decoration of the border of the well-head (eighth century) at the office of the Ministry of Agriculture, Rome, with that on the Saxon Font in Toller Fratrum Church (Fig. 14). Interlacing bands of three strands, bordered by a cable moulding, encircle the top of each ; similar ornament in Saxon MSS. of the eighth century will be found in the British Museum Library as in *Evangelia Nero, d.* 4.

The rough outline annexed (Fig. 15) of the ornament on a late Roman scarcophagus looks almost as if it had been copied from a Saxon MS., so like is it. The sarcophagus of Junius Bassus of the fourth century has Byzantine columns supporting similar arched and pedimental heads alternately, and a sarcophagus in the Lateran Museum of the fourth or fifth century has Byzantine columns with pedimental heads.

FIG. 15.—Ornament on a late Roman Sarcophagus.

The angel carved in stone, built into the north wall of Steepleton Church, near Dorchester, may have decorated the tympanum of the doorway of the Saxon church. The angels on the east wall of Bradford-on-Avon Church are of a similar character. Floating angels, with their robes and legs bent upwards from the knee, may be seen in illuminations in Saxon MSS. in the British Museum. Both angels will be found illustrated in Vol. V. of the Transactions, with notes on them written by the late Professor J. O. Westwood, giving references to similar carvings found elsewhere and to illustrations in Saxon MSS.

This seems to be an instance of Byzantine ornament adopted by Italian workmen. In the Museum of the Bagello at Florence is a small antique carving of Christ in Glory, a *vesica piscis* enclosing the whole figure, with angels of this form and attitude surrounding it, with curiously-drawn symbols of the four evangelists; and in the Syriac Gospels of Rabula of the sixth century in the same city, there are angels represented and similarly treated.

The external arcading, as in the decorative ornament on the walls of Bradford-on-Avon Church, seems to be a modification of late Roman work followed in various forms in Comacine, Lombard, Saxon, and Norman architecture. In its original

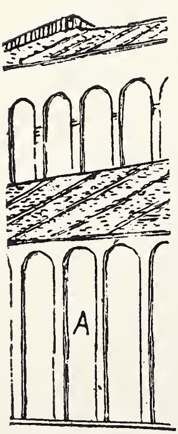


FIG. 16.—*A.* S. Apollinare in Classe (6th Cent.).
B. Apse, San Piero a Grado, Pisa (8th Cent.).
C. Apse, S. Vincent in Prato, Milan (9th Cent.).

form it may be seen on the exterior of the Basilica of S. Apollinare in Classe, Ravenna

(Fig. 16), where external arcadings in the masonry of the walls will be noticed both in the walls of the aisles and in the walls of the nave above the aisles, the arcading being carried on pilasters built into and forming part of the walls, the pilasters, with arcading serving to giving rigidity to the walls, enabling them to resist the outward thrust of the roof, as buttresses were intended to do in later times. This church was built about A.D. 300.

This arcading developed in two directions. First, it was one stage in the evolution of the Saxon pilaster strip, which, however, can be traced back to the late Roman period, for in the façade of the Colosseum at Rome the highest of the four stages is decorated with flat Corinthian pilasters and the lower stages with columns. Examples of the use of the flat pilaster strip in early churches in Italy are shown in Figs. 16 and 17.

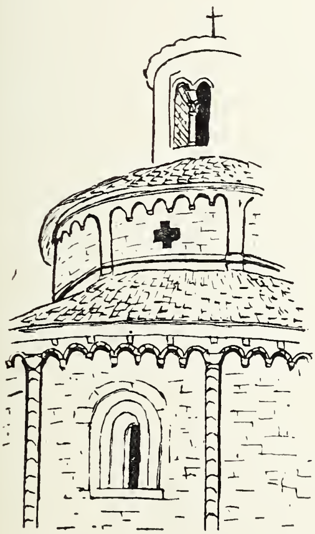


FIG. 17.—Bergamo, S. Thomaso in limine, showing Pilaster Strips, Pensile Arches, and a "Saxon" Window in the upper part.

But, though the flat pilaster strip was used by the Comacines in Italy, the detached column and colonnette was the form of embellishment which was more commonly employed there. As before mentioned, the detached column, as an embellishment, may be seen in the façade of the Colosseum at Rome, built A.D. 80. This continued to be a feature in Roman architecture up to the fifth or sixth century, for in the use of the column the elevation of the apse of the Church of Kalat-Seman, Central Syria (Fig. 18), built in that age, bears a marked resemblance to that of the Colosseum. The

invasion of the barbarians, though it brought Roman art to an end in Italy, does not seem to have caused much local disturbance in Central Syria, where the Roman traditions of architecture were carried on without break till Syria was invaded by the Muhummadan hordes.

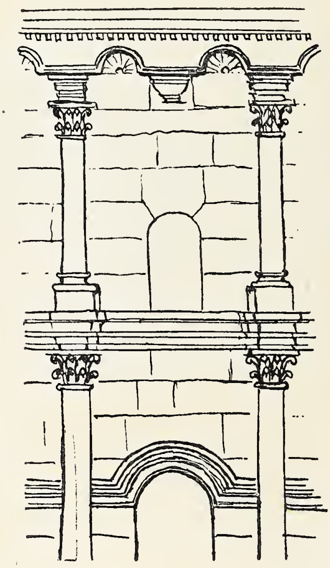


Fig. 18.—Kalat-Seman. S. Simeon Stylites (6th Cent.), detail of Apse.

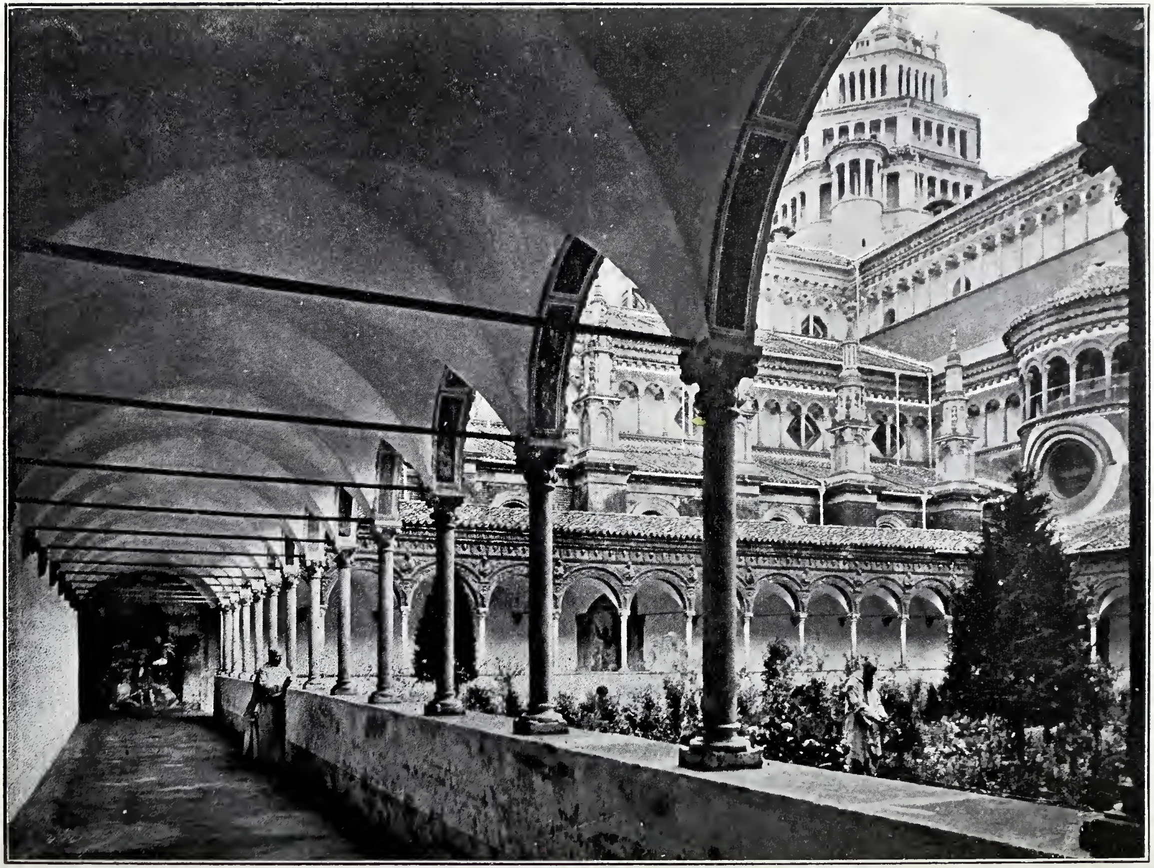
The detached column, treated simply as a decorative adjunct, was employed over the entrance to the palace of Diocletian at Spalatro, which dates from the fourth century, where a series of colonnettes, supported on corbels or brackets, may be observed.

In later centuries the Comacines brought this form of decoration to perfection; the view of the Certosa of Pavia from the small cloister (see illustration) shows how effectively it was employed by them in the fourteenth and early fifteenth century.

The arcading developed in another direction; omitting the pilaster or column, it became the pensile arch of the Comacine style known as Lombard.

The examples in Figs. 15 and 16 will show the evolution of the little pensile arch; each arch is supported by stones built into the wall, which thus became a bracket or corbel, and in after years this ornament modified and, with the corbel more pronounced, became the Norman corbel table.

There is a fret which decorates some crosses, and is apparently of later date than the ornament derived from Roman art, for it is not—so far as I know—represented on any Roman pavement or



View of the Certosa of Pavia, from the Small Cloister.

sculpture; it has somewhat the appearance of a Japanese fret. Professor Westwood, speaking of the Pen-yr-allt stone near Bridgend, says of this fret:—"The stone, facing the south, is entirely filled with sculptured patterns coarsely executed, the upper part being composed of a modification of the Chinese-like design common in manuscripts." * The design may, therefore, have been taken from a manuscript, or it may be developed from a Greek fret.

As to sculptures, Saxon sculptures were generally vigorous and often grotesque. A writer in "Archæologia" (Vol. VIII., p. 174), states that in the vaults of Hexham there were at the time he wrote many Roman inscriptions and grotesque carvings. The capitals of columns in Saxon as well as in later times not infrequently bore grotesque ornament for decoration, and it was commonly used for other purposes. Reginaldus de Coldingham (de virtutibus S. Cuthberti) describes the double coffin of St. Cuthbert, the inner one being black oak elaborately and grotesquely carved, the subject of one of the carvings being a monk turned into a fox for stealing new cheese.

Comacine carvings of early date were of the same character. Gundeberg, daughter of Theodolinda, who married King Rotharis, built the Church of S. Giovanni in Borgo at Pavia † in the seventh century.

This was said to be, after S. Michele, the finest building of the age. The description of it reads like a description of Hexham Church previously noticed. Unfortunately, "this interesting church was destroyed in 1811, and its symbolic relief and carved stones ruthlessly used in the foundations of modern buildings. Some were, however, saved by a nobleman of Pavia, Don Galeazzo Vitali, and are preserved in his villa between Lodi and Pavia. Here on May 13th, 1828, the Signori Sacchi ‡ went to see them, and found many specimens of

---

* Westwood's Lapidarium Walliæ, p. 47.

† Paul Diac. lib. IV. c. 4.

‡ *Antichita Romantiche d'Italia,* da Difendente e Giuseppe Sacchi, p. 70 et seq.

Comacine symbolical and grotesque art. Here are square slabs, which may have been parts of friezes or *plutei* (panels of marble), covered with interlaced work formed of entwining vines, or even serpents; sometimes a simple cord in mystic and continuous knots, precisely similar to the ones recently discovered in S. Agnese and S. Clemente at Rome. There were several capitals of columns and pilasters with significant grotesques, such as a man between two lions, a maze of vines with a satyr in them . . . . two armed warriors on horseback meeting in battle. (There is a similar capital in S. Stefano at Pavia.) In one two hypogriffs meet at the angles; in another two dragons, with tails intertwined, are biting a man between them placed at the angle." *

The Byzantine character of some of the ornaments in Comacine and Saxon work is accounted for by the fact that the Comacine Order found refuge in a Romano-Greek colony in which the Greek influence was strong, and in all probability there were Byzantine guilds working alongside of it.

That there is a trace of Oriental form in it is not surprising, when it is remembered how much communication there was between all parts of the Christian world, notwithstanding the difficulties of travelling. To take some instances as they suggest themselves, and almost at random.

Teliau, David, and Paternus journeyed to Jerusalem. On arriving at the Temple, they were placed in three ancient stalls in the Temple (or church), and, after expounding the Scriptures, were elected by the people and consecrated bishops (vita S. Teliaui Episcopi). Columbanus, an Irish saint, established a monastery amidst the ruins of the ancient Roman city of Bobbio in Italy. S. Cumean, born in 592, obtained possession of a deserted church in the same city, restored it, and served it.

According to the Chronicles of Fontenelle, bishops and clergy, abbots and monks came from all parts, even from Greece and Armenia, to visit Richard, Duke of Normandy, brother-in-law

---

* *The Cathedral Builders*, by Leader Scott, p. 43.

of our Saxon King, Ethelred, and a great church-builder; the Oriental character of some of the ornaments in Oxford Cathedral, which Ethelred rebuilt, is attributed to the influence of Richard and his Oriental visitors, for Ethelred took refuge in Normandy for a time to avoid the Danes.

Some Saxons left England at the Norman Conquest and settled in Constantinople, where they built a church for themselves and other members of the Saxon colony there.

S. Germanus, when he left Britain, went to Ravenna, then the Royal City.

Asser relates that Alfred received Embassies daily from foreign parts, from the Tyrrhenian Sea to the farthest limits of Spain, and that he had seen letters and presents which had been sent to the King by Abel, Patriarch of Jerusalem.

Many British monks, some of whose lives and legends may still be found in early MSS., travelled to the south and east and all over the known world, and those skilled in architecture might readily have made copies of ornaments which took their fancy when travelling in eastern countries and introduced them on their return.

To re-state the argument briefly:—

1. When Italy was overrun by the barbarians, Roman Collegia were everywhere suppressed.
2. The Architectural College of Rome is said to have removed from that city to the Republic of Comum.
3. In mediæval times one of the most important Masonic guilds in Europe was the Society of Comacine Masters, which in its constitution, methods, and work was essentially Roman, and seems to have been the survival of the Roman College.
4. Italian historians assert that architects and masons accompanied Augustine to England.
5. Whether this is proved or not, it was customary for missionaries to take in their train persons experienced in building, and, if Augustine did not do so, his practice was an exception to what seems to have been a general

rule. Besides, a band of forty monks would have been useless to him, unless some of them could follow a secular calling useful to the mission, for Bede informs us that they were unacquainted with the British language, and therefore could not act independently.

6. Masonic monks were not uncommon, and there were such monks associated with the Comacine body, so that qualified architects were readily found in the ranks of the religious orders.
7. Gregory would be likely to choose architects for the mission from the Comacine Order, which held the old Roman traditions of building, rather than those of a Byzantine guild, and the record of their work seems to show that he did.
8. In Saxon, as in the earlier Comacine carvings, there are frequent representations of fabulous monsters, symbolical birds and beasts, the subjects of some of these carvings being suggested apparently by the "Physiologus," which had a Latin origin.
9. It may be added that in the writings of the Venerable Bede and Richard, Prior of Hagustald, we meet with phrases and words which are in the edict of King Rotharis of 643 and in the *Memoratorio* of 713 of King Luitprand, which show that these writers were familiar with certain terms of art used by the Comacine Masters.*

* Merzario, I Maestri Comacini, Vol. I., Chap. ii., pp. 87-89.

An Experiment on the Movements of a Load of Brickbats Deposited on the Chesil Beach.

By NELSON M. RICHARDSON, B.A., F.E.S.

(Read Feb. 25th, 1902.)

THE experiment which forms the subject of the following paper was carried out by myself in December, 1898, after consultation with Dr. Vaughan Cornish, who most kindly offered to bear half the expense of this and a possible future series of experiments of a similar nature. As more than three years have, however, now elapsed and these further experiments are still unmade, I have thought it best, having obtained Dr. Cornish's approval of that course, to lay the results before the Dorset Field Club.

Dr. Cornish's observations on the Chesil Beach, with which it had been originally intended that these results, as well as those of the further experiments alluded to above, should be incorporated, are contained in the "Geological Journal" for May and June, 1898, and in the "Proceedings of the Dorset Field Club," Vol. XIX., p. 113.

We agreed that it would be best to make the first experiment with brickbats, these being the only things conveniently available that answered, though imperfectly, to the conditions of being easily distinguishable from the pebbles, and yet approximating to them in size, hardness, and specific gravity. On December 19th, 1898, a load of brickbats, nearly all half bricks or thereabouts, but with a slight mixture of three-quarter and quarter bricks, was carted down to the Fleet, taken across in a boat, and carried in baskets over the beach and thrown into the sea about half way between high and low water-marks. Eighteen basketfuls of about 26 half bricks each were carried over and a few by hand, so that the total number was about 480.

The tide was low at about 3.0 p.m., and the bricks were thrown in between 11.30 a.m. and 1.15 p.m. A few (about 50) were not covered by the sea till the next day.

It was new moon on December 13th, so the tide was a fairly high one.

The direction of the Chesil Beach from Bridport to the beginning of Portland is from a point between N.W. and N.W. by W. to a little E. of S.E., and it is convenient sometimes to speak of the Bridport end as the N.W. end and the Portland as the S.E. end. They are often spoken of as the W. and E. ends respectively, but this is perhaps apt to convey a wrong impression of the real direction.

There was a slight breeze from the N.N.W., and the waves, which came somewhat from the Bridport end, instead of straight on to the shore, were not large—perhaps 2 feet high or less. The bricks were very soon, generally in a few minutes, washed down out of sight, and some occasionally washed up again and then taken down, so that they required to be noted immediately they were seen, or they would probably disappear.

I took the following notes at the times mentioned. I found that none of the bricks moved towards Bridport, except that once one was seen a few yards north-westwards of its original position.

The bricks were deposited opposite to the flagstaff of the Fleet Coastguard Station, which is erected at the top of the beach.

Below this the continuous slope of the pebbles to the sea is broken by several small secondary ridges, of which one lies parallel to the sea, and at 3.0 p.m. was distant from it about 15 yards. This small ridge, which is regular and continuous for a long way on each side of the flagstaff, and is marked D in the accompanying sectional plan of the beach, I have used as a basis from which to measure the position of the bricks to show how far they have been cast up by the waves.

These secondary ridges are not at all constant, but frequently change their form and position.

The current south-eastwards was most of the time from 12.0 to 3.0 about 20 yards a minute, as judged from floating objects thrown in, but part of this would be due to the wind. There were about nine waves per minute.

The following notes show the distances travelled by some of the bricks up to 2.0 p.m. :—

11.30 a.m.	First basket of bricks emptied.
12. 0	One brick 10 yards to S.E. of flagstaff.
12.45 p.m.	Three bricks cast up nearly beyond the reach of the waves at 7, 8, and 12 yards to S.E. of flagstaff. Several 20 yards to S.E. below in the waves.
1. 0 p.m.	One brick rather high at 25 yards S.E.
1.20 p.m.	,, ,, stranded at 26 yards S.E.
1.30 p.m.	,, ,, [rather a large one (A)] 37 yards S.E.
1.45 p.m.	,, ,, (a small half) 46 yards S.E.
,,	,, ,, 56 yards S.E.
2. 0 p.m.	,, ,, [same as (A) ?] 50 yards S.E.

From 2.45 to 3.0 p.m. I noted the positions of the bricks, which were then visible, but their appearance was often only momentary. The approximate distance below the ridge is also given in the following table :—

Distance S.E. of Flagstaff in Yards.	Distance below Ridge in Yards.	No. of Bricks.	
0–6	3—15	19	At various heights.
10	6, 8—15	6	
11	—	1	
12	1, 10, 11	3	
16	7	1	
17	7, 7, 11	3	
20	1, 8	2	
21	7, 11	2	
25	6	1	
26	2	1	A big wave would sometimes nearly reach the ridge, but not usually.
27	1	1	Size of hen's egg.
29	6	1	
33	8, 11	2	
51	7	1	Size of hen's egg.
53	7	1	This half brick and many others were very slightly worn at the corners and edges by the pebbles, which greatly exceed them in hardness.
		45	Total number seen.

On the next day, December 20th, I reached the flagstaff at 3.10 p.m. and walked south-eastwards towards Portland, noting the positions of the bricks visible. The wind was much the same as yesterday and very slight; the waves were smaller and came somewhat from the Bridport end. As before, the bricks were washed up and then back again, so that some visible on my outward walk were not so when I returned and *vice versâ*. The water on both days was thick, so that, if a brick was covered by it, I could not see it at all. On returning to the flagstaff from my south-eastward journey, I went north-westwards for 300 yards, but saw no bricks. Before leaving at 4.0 p.m. I threw in about 50 bricks (the last two basketfuls) which had not been taken down by the sea, being deposited about high water-mark.

The following are the notes taken by me to-day, the ridge, &c., referred to being the same as yesterday. All bricks visible were on the Portland side of the flagstaff, except one about 3 yards N.W.

Distance S.E. of Flagstaff in Yards.	Distance below Ridge in Yards.	No. of Half Bricks.	
9	—	1	Perhaps only washed down this tide, as well as the one 3 yards to N.W.
10	—	1	
20	—	1	
68	10	1	
70	9	1	
71	8	1	
85	10	1	
107	10	1	
272	8	1	This is not the only instance in which 2 bricks occur close together far from others.
273	8	1	These were carried out of sight just as I returned.
294	10	1	Out of sight when I returned at 3.35.
334	8	1	
360	8	1	
373	—	1	Stranded just above ridge.
574	—	1	A quarter brick stranded just above ridge. I went on to 650 yards, but saw no more.
		15	Total number of bricks observed.

On December 21st I paid a third visit to the beach, arriving there at 3.30. The wind was exceedingly slight and E.N.E. and the sea almost calm and fairly clear, so that I could have seen a brick a yard or two beyond its edge. I first went about 250 yards to the N.W., but saw no bricks at all; then 1,000 yards to the S.E., but only saw one brick (at 126 yards) on my way out. Coming back, however, I saw 3 more as follows :—

At 126 yards 1 brick 6 yards below ridge.
,, 179 ,, 1 ,, 8 ,, ,, ,,
,, 337 ,, 1 ,, 8 ,, ,, ,,
,, 338 ,, 1 ,, 8 ,, ,, ,,

The proximity of the last two is very remarkable. The last was about three-quarter brick, the others halves.

There was to-day a very slight drift to the N.W., which would suggest that the tide was coming in, but I doubt if this was really the case when my observation was taken about 4.0 clock. It was probably the effect of the wind. The sea was higher than on December 19th, being only about 8 to 10 yards below the ridge.

I learn from the fishermen that the tide in the Fleet at this part is about two hours later than the tide in the sea outside, and to-day at 4.30 it was getting low in the Fleet and still running out fast.

December 22nd. I did not visit the Beach. Wind S.

December 23rd. Wind a slight breeze from about S.E., waves coming somewhat from the Portland end. Sea a little rougher than on the 19th inst.; waves sometimes about 3ft. high and about ten to the minute.

I left the flagstaff at 11.0 a.m. and walked 1,200 yards to the S.E., but saw only two pieces of brick.

At 570 yards S.E. a quarter brick stranded just below ridge.

250 yards S.E. a small bit of brick just on ridge.

I walked from the flagstaff towards Bridport, more than 200 yards, but saw no bricks.

At the retreat of the wave a distance of 10 to 12 yards below ridge was uncovered.

I watched the movement of a stone about 4 inches long, much longer than the average shingle at this part. It appeared to be much more influenced by the waves than the smaller stones, and in the course of between one and two minutes was carried about 2 yards to the N.W., chiefly by one large wave. A small tin canister partly full of water, *but floating*, was carried 14 yards N.W. by the broken waves before stranding in 20 seconds, and again, when thrown into the surf, 15 yards N.W. in 60 seconds. Other stones, &c., were also moving north-westwards at a considerable rate.

The movement of the stones appears to be caused by the direction of the waves, which reach the beach and break obliquely to it, carrying the stones, &c., in an oblique direction up the beach, to-day north-westwards. Then, when retreating, the wave continues its north-westerly direction and carries the stone still more north-westwards down the beach.

The motion of a large stone along the beach in the direction of the wind N.W. is, therefore, very rapid in a succession of curves.

The north-westerly motion of a cork too far out to be influenced by the *broken* waves was about 30 yards per minute, due to wind and tide, which was rising and flowing north-westwards. In the last two days a slight alteration has taken place in the form of the beach below the ridge, from which measurements have been taken, a new small ridge having been formed about 5 yards below it, instead of there being, as before, a continuous curve from this ridge to the water.

It appeared to me that the pebbles rolled back much less with the retreating wave than on December 19th, 20th, and 21st, when the tide was falling.

January 20th, 1899. I have made enquiries several times and have instructed men to be on the look out, but since the gales which have been taking place towards the end of December and in January nothing has been reported—only one half brick near Fleet early in January.

On December 20th I found that by the sea there was a quantity of very small gravel, much smaller than that of the beach above. There were a few of these larger stones amongst it, and an occasional still larger one could be seen. On the shore of the Fleet at this point, on the inland slope of the beach, the shingle is three or four times as large as on the seaside, and these larger stones extend in diminishing quantities nearly to the top of the beach on the Fleet side. A few still larger stones, some very large (1 foot or so long), are scattered through the shingle.

There are two features in this experiment which strike me as important, and on which I propose to say a few words.

(i.) As to the speed at which a stone may be carried along the beach.

(ii.) The apparent fact that a large stone lying amongst a mass of smaller shingle of uniform size may be carried along the beach by the waves at a very much greater rate than any of the smaller stones composing the shingle.

First, as to the great speed attained.

The greatest observed speeds, assuming that all the bricks started at 11.30 a.m. on December 19th (which was the time when the first one might have started) were :—

56 yards in $2\frac{1}{4}$ hours from 11.30 a.m. to 1.45 p.m. and

574 yards in 28 hours from 11.30 a.m. on December 19th to 3.30 p.m. on December 20th.

These correspond approximately to speeds of 25 and 20 yards per hour respectively, or 1 mile in three or four days.

Thus the whole 18 miles from Bridport Harbour to Portland would be traversed in 54 or 72 days.

Again, it will be remembered that a large stone was observed to travel at the rate of about 2 yards in $1\frac{1}{2}$ minutes on December 23rd, when it was a trifle rougher than on December 19th and 20th, when the other speeds were calculated. This corresponds to a speed of 80 yards per hour, a mile in 22 hours, or the whole 18 miles in $16\frac{1}{2}$ days.

The speeds deduced from the bricks which travelled long distances would probably be too small, because so few of those at these distances were in sight at any one time, so many being washed down by the sea and occasionally washed up again that the brick observed on December 20th at 574 yards was probably by no means the furthest one from the starting point. Bricks were continually disappearing and reappearing after an interval, and, could a continuous watch have been kept at all points, much greater speeds might have been recorded.

It would be practically impossible, unless one were using a very large mass of material, to test the speed of a brick during a gale, but, if in an ordinary slight breeze a stone can move at a rate which would take it from Bridport to Portland in $16\frac{1}{2}$ days, I cannot think that there would be any difficulty in its performing the same journey in a strong westerly gale in as many hours. Now, gales and strong winds are not very uncommon on the beach, and they mostly tend more or less from west to east, so that, given a big stone anywhere on the beach, it would be sure before long to have an opportunity of travelling to the Portland

end, where are found the bulk of the larger stones which occur along it.

The second point which appeared to me to be prominently brought out by the experiment was that an isolated large stone amongst a mass of much smaller ones is far more affected by the sidelong force of the waves than they are.

In the case of two stones of different sizes lying alone on a sandy shore the smaller will, of course, be much more easily moved by the waves than the larger. The apparently contradictory phenomenon in this experiment seems to depend on the fact that the smaller stones lie in a more compact mass, and, even if disturbed, easily settle down again, and the waves move, as it were, over them as over a solid floor without producing much effect. If a few do get carried to a little distance, they soon drop into new places a little further on, and their progress ceases. But, if a considerably larger stone is placed on them, the waves take hold of it immediately and force it onwards, and it may go a long distance, as wave after wave catches it, before it sinks into a resting-place among the little ones. Even then the first disturbance of its surroundings sends it off again on its travels.

This may be seen in the distances traversed by the bricks, which were much larger than the shingle over which they passed, and also by the large stone, whose movement I noted on December 23rd, and other large stones which behaved in the same manner.

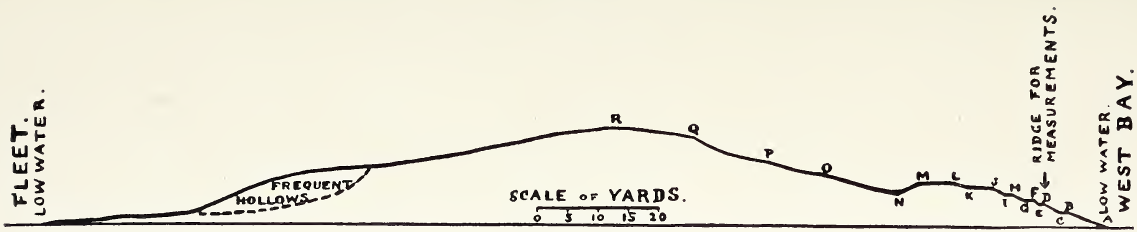
Now, it is only for a short distance at the Portland end of the beach that we find any accumulation of what can be called large stones, the average weight of the pebbles for more than 16 miles out of 18 being less than an ounce, according to the weights given by Dr. Vaughan Cornish in his valuable paper on this subject read before our Club on July 15th, 1897 ("Proceedings," XIX., 113).

There would, therefore, appear to be no difficulty about the transit of a large stone from any part of the beach to this eastern end. Once there, the same law, that similarly sized

stones lying in a mass together were not much moved along by the waves, would doubtless apply to these large ones as well as to the smaller ones, in which it seemed to hold good, and make its return less easy. The cause suggested by Dr. Cornish, that the protection afforded by the projecting promontory of Portland would lessen the power of the waves coming from the east to move big stones would doubtless also lead to the same result. In any case, if a large stone did travel towards Bridport some little way, it would soon be brought back by the prevailing tendency of the wind towards the east.

With regard to the large stones which are found in considerable numbers on the Fleet side of the beach away from the sea, they have doubtless been thrown over the ridge in gales whilst travelling along, and, once on the inside, there is nothing to further disturb them, so that they do not move up to the Portland end like those on the seaside. It will be noticed that the travelling of stones over the surface of sand faster than the grains of sand themselves is another somewhat extreme instance of what I have observed on the Chesil Beach with regard to the large stones, and is probably to be explained in the same way.

And it seems to me that the same cause is quite sufficient to account for the accurate placing at that point of the Chesil Beach, where similarly sized stones are found, of any stone or stones which are supplied to the Beach on the seaside at Bridport Harbour. A stone, weighing say $\frac{1}{3}$ ounce, starting at Bridport Harbour, would go on travelling towards Portland, with various stoppages and retrograde movements owing to easterly winds, until it reached a point where it ceased to be larger than the shingle around it. This would occur in the neigbourhood of Fleet Coastguard Station, where the average weight of a pebble is given by Dr. Cornish as ·342 ounce, which is almost exactly this size. It would then lose its individuality and form a permanent particle of the whole beach at that point, until from the very slow grinding process its weight became reduced and fitted it for some "smaller" position.



The above plan represents a section of the Chesil Beach at a point 1,200 yards S.E. of Fleet Coastguard Flagstaff on Dec. 23rd, 1898. The small secondary ridges (which are always changing in position and number) are marked B, D, F, H, J, L, M, O, P, Q, R, the latter being the top of the Beach. The corresponding troughs are C, E, G, I, K, N. Of these N is the most striking, being from 2ft. to 3ft. below the level of M, L. The small ridge D, which was used for measurements, was very uniform and well marked along the mile of the Beach observed and was practically constant during the days of observation. The inner slope of the Beach has generally no ridges, but in the lower portion there are large hollows scooped out at intervals which are frequently overgrown with vegetation which binds the stones together so that the contour does not alter.

The plan does not lay claim to extreme accuracy as it was made without instruments, but may be taken as fairly correct.

Returns of Rainfall, &c., in Dorset in 1901.

By HENRY STORKS EATON

(Past President of the Royal Meteorological Society).

NO addition has been made to the staff of observers, though there are some slight changes in the arrangement. By the removal of Mr. W. Symes the Portisham register came to an end at the close of June, but Mr. Symes started a fresh station in Poole Road, Bournemouth, without delay; and Binnegar Hall, which in former reports has come under the head of Wareham, now more appropriately appears under East Stoke, in which parish it is situated.

The deficiency of rain at Portville, Bridport, noticed in last year's report, has not been satisfactorily explained, and the returns are therefore rejected. The comparison this year is:—Coneygar, 34·97in.; Portville, 28·94in.

At Herringston an ordinary 5-inch gauge has been substituted for the original instrument, in which a defect had developed. In the result the amount of rain collected is greater. For the first time more has been measured at Herringston than at Dorchester. Lying close under the lee side of Ridgeway Hill, and nearer to it than Dorchester, the larger rainfall at Herringston accords with what is generally observed under similar

circumstances. The rainfall constant for Herringston given in the Appendix to the Report for 1898 is therefore inapplicable.

	Dorchester Waterworks.	Herringston.	Herringston less.
	in.	in.	in.
1897	36·19	33·51	– 2·68
1898	27·92	27·32	– ·60
1899	36·56	34·38	– 2·18
1900	38·00	37·82	– 1·18
1901	30·53	33·36	+ 2·83

The registers from Bloxworth Rectory, Cattistock, and Cheddington are unchecked, as the schedules supplied for entering the rainfall day by day have not been returned for examination; but all the other registers have been carefully collated and discrepancies investigated. If the year has not been signalised by any marked progress, on balance there has been no falling off in the number of completed returns, which remains at 44. The resumption of observations by the Rev. S. Poole at Chickerell Rectory, and the Piddletown journal, which now comes in for the first time, makes up for the loss of Portisham and Portville.

An inch of rain fell on 13 different days; of these days 1 occurred in February, March, June, August, and October, 2 in December, and 3 in July and September. The 14th of August was the wettest day with an average of 1·61in. of rain at 44 stations. At Herringston 2·90in. fell in about ten hours; 2·40in. at Wollaston House, Dorchester; 2·34in. at Piddletown; 2·13in. at Wyke Regis; 2·10in. at Dorchester Waterworks and Steepleton; 2·06in. at Fleet House; and 2·00in. at Shroton. The smallest fall on this day was ·86in. at Holwell and 1·01in. at Sherborne Castle. Another wet day was the 16th of September with 2·05in. of rain at Blackdown and Coneygar Hill and 2·03in. at Cheddington; the average fall was 1·32in., the smallest, ·68in., at Portland Bill, and ·80in. at the Victoria Hotel, Swanage. The last wet day that need be noticed was the 28th of December, when the average depth of rain was ·90in. Falls of 2·18in., 2·07in., and 2·04in. were recorded respectively at Broadwindsor Vicarage, Blackdown, and Cheddington. At Swanage ·36in.

was measured at Mintern House by the Rev. H. Pix and ·37in. at the Victoria Hotel by Mr. Vincent.

The number of rainy days deduced from twenty-eight stations, chosen in the same way as last year and marked with an asterisk in Table III., was 153.

The ratio of the rainfall was 89·8 per cent., or slightly more than 10 per cent. under the average. The highest ratios were:—Coneygar Hill, 106·4; Blackdown, 102; Beaminster Vicarage, 95·2; Cattistock Lodge, 93·2. The lowest:—Houghton, 81; Gillingham, 81·7; and Sturminster Marshall, 82·9. In absolute depth Blackdown House heads the list with 39·33in., followed by 39·28in. at Cattistock. The smallest falls were 23·71in. at Portland Bill, and 24·02in. both at Chesil and Weymouth.

Electrical disturbances were more frequent than usual. Thunderstorms, or lightning or thunder, were recorded on the 1st and 2nd of March, 5th of May, 23rd, 29th, and 30th of June, 13th, 24th, 25th, 26th, 27th, and 28th of July, 14th and 27th of August, the 7th, 8th, 14th, 16th, and 30th of September, and the 1st of October. A thunderstorm on Sunday, the 28th of July, fell with great severity on Broadmayne, and to a less extent on West Lulworth, where the Rev. W. P. Schuster recorded a fall of 1·55in. of rain.

The following are extracts relating thereto from the *Dorset County Chronicle* of August 1st:—"On Sunday morning, about 10 o'clock, a terrific thunderstorm burst over the village (Broadmayne) and neighbourhood, and continued for two hours. Rain fell in torrents. So violent was the downpour that some labourers' potato plots situated on the high lands near Fryer Mayne were washed out. . . . The rush of water was so great that it was thought there had been a waterspout burst upon the hills. . . . A dairy cow on Fryer Mayne Farm was struck by lightning and killed. . . . Many sensational stories are told about the waterspout, or the extraordinary accumulation of thunder rain thought to be a waterspout. . . . When the supposed waterspout swept down into the

village, the main street appeared for the time as if it were a stream." West Lulworth.—"On Saturday and Sunday morning, between the hours of 11 a.m. and 1 p.m., a very heavy thunderstorm broke over the village accompanied by almost incessant and very vivid lightning and a most unusual downpour of rain. On Sunday many houses were inundated in the lower rooms, and the roads were practically impassable in several places. Such a flood has not been known for over 20 years.

Observers' Notes.

Bridport.—As regards the difference in the two gauges (at Portville and Coneygar Hill) I find that in stormy weather the Portville one almost invariably registers less than the Coneygar. This is, I think, through its being nearer the sea, the other being on the hill to the north of the town.

Broadwindsor Vicarage. — March 2nd, 8.30—9 a.m.: Lightning, thunder, and hail. April 15th: Hailstorms in morning and afternoon. May 7th: Hail in morning. June 29th: Thunderstorm during great part of night; 30th: Thunder. August 14th: Steady rain all day. December 28th: Houses flooded, roads torn up and blocked.

Chickerell, Montevideo.—Rain on 37 days to a less amount than ·01in. January 8th: The amount of (melted) snow in the gauge was ·42in.; but by inverting the gauge on snow where it was of average depth, ·47in. was obtained. The amount recorded is ·45in. 9th: Very rapid thaw in the afternoon. June 29th: Thunder and very bright and continuous lightning in the evening and night, also on the morning of the 30th; it never came very near here. July 26th: Thunderstorm a long way off in the morning; saw no lightning; very heavy showers of rain. 27th: Thunderstorm in the morning much the same as on the 26th; no lightning. 28th: Thunder very far off in morning and afternoon; no lightning. September 7th: Thunder in the afternoon a long way off; 14th, thunder in the morning a long way off. November 5th—9th: Heavy dews accumulating in the rain gauge.

Dorchester, Wollaston House.—The rainfall of August 14th was very remarkable; there was no thunder as generally is the case in summer with heavy rain.

East Stoke, Binnegar Hall.—January gave us a very sharp frost during the night of the 8th, an exposed thermometer going down to 12° after a fall of snow in the daytime. A rapid thaw set in next day. September 20th: Violent rain at 10.30 a.m., and again at 5 p.m. and after, from S.W., measuring 1·75in. next morning.

Fleet House.—January 8th: 6in. of snow in three hours.

Lyme Regis, Colway Cottage.—June 30th: Thunderstorm. July 24th: Thunderstorm, rain 1·01in.

Melbury Sampford.—March: For the first few days hailstorms with lightning and thunder. July: Towards the end of the month heavy thunder and rain.

Parkstone, Heatherlands.—A second gauge gave 29·12in. of rain for the year.

Portland, Chesil.—June 25th: As the sun was setting a remarkably clear and bright sun pillar was seen. It was distinctly seen until 9 o'clock, being visible nearly an hour. The horizon was draped in a thick dark mist, so that the actual sun-setting was not seen. The sun was a vivid crimson, and the pillar rose perpendicularly to a height of fully 40° of arc above the horizon. Its colour was a yellowish crimson and presented a most striking appearance. This somewhat rare phenomenon will never be forgotten by those who watched it. It appeared as a reflection of solar light from the dense particles of mist which filled that portion of the atmosphere. The barometer stood at 30·43in., thermometer 70°. The humidity was 94. 23rd: In the early morning there was a thunderstorm accompanied with considerable wind, which damaged gardening products. The rainfall was under ·01in. 29th: Moderate thunder and lightning. July: Thunder on the 24th, 25th, 26th, 27th, and 28th; lightning seen on the 26th, 27th, and 28th. August 27th: Lightning. September 7th and 8th: Thunder; 14th and 30th: Thunder and lightning.

Sherborne, Coombe Farm.—March 1st, 12.30 p.m.: Three vivid flashes of lightning with thunder in the north; 2nd, 5.30 p.m.: One flash of lightning with thunder in the same direction. May 5th: Thunderstorm passed north from here to east. One loud clap of thunder; no rain worth mentioning within a mile. June 29th: At 4.30 p.m. distant thunder, S.W.; the storm passed to N.W. About 8 p.m. vivid flashes of lightning with thunder in the east. This storm came slowly overhead about 9.45 p.m. The ground was quickly covered with hailstones, or rather oblong lumps of ice and irregular icicles, measuring up to 3in. round. The rain gauge produced ·25in. in fifteen minutes. The lightning and thunder continued till about 11 a.m. on the 30th. The ground was covered with leaves and small branches cut from trees. July 13th, 25th, and 28th: Thunderstorms; 18th: Highest temperature on north wall, 87°.

Winterbourne Houghton.—January: The 6th and 7th were the coldest days with a maximum temperature of 29°. There was a fall of snow between 11 a.m. and 3 p.m. on the 8th. The most remarkable feature of the frost was the abrupt break up, when, from the minimum of 10°·5 on the night of the 8th, the temperature rose to a maximum of 44° on the 9th. March 1st: A thunderstorm passed over from N.W. to S.E. between 3 and 4 p.m. June: On the night of the 29th–30th a severe thunderstorm occurred, the special feature of which was an extraordinary hailstorm at 12.20 a.m., when a good deal of glass was broken. The hailstones were very large, and were to be found two days after. August: Rain on the 14th fell in a calm air. October 1st: A thunderstorm between 6 and 7 p.m.

Extremes of Temperature.

	Max.	Min.		Max.	Min.		Max.	Min.		Max.	Min.
	°	°		°	°		°	°		°	°
Jan.	..	10·5	April	71·5	29·0	July	87·5	48·0	Oct.	69·0	33·0
Feb.	49·5	18·0	May	74·0	33·0	Aug.	77·0	46·0	Nov.	55·0	23·0
Mar.	56·0	24·0	June	80·5	40·0	Sept.	71·5	41·0	Dec.	53·5	20·0

TABLE I.—MONTHLY DEPTH OF RAIN IN INCHES IN 1901.

Observer.	Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
J. C. P. White	Abbotsbury, New Barn	2·26	1·19	2·76	2·77	1·19	1·25	2·37	2·05	3·04	3·69	·47	4·90
J. Andrews	Beaminster, Fleet Street	3·61	1·56	3·35	3·63	2·00	1·39	2·08	2·62	4·25	2·86	·85	7·60
Rev. A. A. Leonard	,, Vicarage	3·64	1·48	3·53	3·81	2·08	1·42	2·03	2·68	4·40	2·98	1·02	7·89
Rev. W. E. H. Sotheby ..	Bere Regis Vicarage	2·45	1·51	2·19	2·93	1·11	1·80	2·52	2·03	5·13	2·60	·54	4·33
Rev. O. P. Cambridge ..	Bloxworth Rectory	2·16	1·58	2·54	2·99	1·13	1·58	2·34	2·23	5·24	2·63	·75	5·00
H. Gordon	Bridport, Coneygar Hill	2·97	1·26	2·37	3·02	1·68	1·69	3·11	2·54	4·61	3·64	·67	7·41
Rev. G. C. Hutchings ..	Broadwindsor Vicarage	3·38	1·42	3·37	3·55	2·27	1·34	2·35	2·48	4·41	3·06	·78	8·36
C. E. M. Pinney	,, Blackdown House ..	3·51	1·69	3·78	3·58	2·25	2·08	2·26	2·17	5·14	3·21	1·04	8·62
Rev. W. H. H. D'Aeth ..	Buckhorn Weston Rectory	2·56	1·39	2·58	2·08	1·16	1·27	3·23	2·59	2·45	1·85	·58	4·76
E. S. Wilmot-Sitwell ..	Cattistock Lodge	3·21	1·81	3·39	3·67	2·00	1·08	3·73	2·18	5·33	4·28	·88	7·67
Rev. G. H. Billington ..	Chalbury Rectory	2·10	2·39	2·08	2·52	1·03	1·71	2·12	2·36	3·26	3·41	·48	4·89
H. Birkinshaw	Cheddington Court	3·69	1·84	2·72	3·66	2·22	1·55	1·90	2·23	4·86	2·86	1·12	8·13
Mrs. Richardson	Chickerell, Montevideo	2·24	1·18	2·42	2·75	·94	·77	1·93	2·36	3·29	4·01	·45	4·46
Rev. S. Poole	,, Rectory	2·02	1·18	2·09	2·08	·95	·75	1·85	2·47	2·96	4·10	·44	3·88
G. J. Hunt	Dorchester, Waterworks	2·42	1·43	2·43	3·52	1·19	1·14	1·49	2·77	4·06	3·50	·60	5·98
Captain J. E. Acland ..	,, Wollaston House	2·78	1·47	2·38	3·38	1·15	1·08	1·70	2·97	3·98	3·13	·54	6·22
O. C. Farrer	East Stoke, Binnegar Hall	2·06	2·10	2·78	2·60	1·04	1·47	1·92	2·71	4·65	2·48	·69	5·18
Mrs. George	Fleet House	1·78	1·17	2·56	2·86	·98	·90	2·15	2·49	3·09	3·86	·42	4·39
S. H. Stephens	Gillingham	2·41	1·55	2·70	2·48	1·11	·96	1·60	2·83	2·63	2·16	·71	5·85
G. Coffin	Holwell, Westrow	3·46	2·02	2·31	2·96	1·75	·96	2·74	1·88	3·53	2·82	·77	6·84
Rev. G. Wellington	Horton Vicarage	2·27	2·34	2·41	2·68	1·04	1·54	2·67	2·49	3·11	3·15	·59	5·68
Rev. W. P. Schuster ..	Lulworth, West, Vicarage	1·89	1·54	3·46	3·07	·94	1·23	3·44	2·34	4·05	3·54	·69	4·55
Dr. J. Spurr	Lyme Regis, Colway Cottage	3·20	1·42	2·32	3·41	1·69	1·53	2·18	1·84	3·84	2·62	·81	6·67
R. Rintoul	Melbury Sampford	2·53	·95	3·23	3·71	1·97	1·35	3·40	1·99	4·10	3·02	1·09	7·82
R. H. Barnes	Parkstone, Heatherlands	2·32	2·16	2·54	2·72	·85	1·44	1·87	2·04	3·90	2·98	·65	4·92

TABLE I (CONTINUED).

Observer.	Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
W. Symes	Parkstone, Poole Road, Ben Hin ..	..	..	..	..	..	..	1·89	2·03	3·68	2·84	·61	5·08
J. Powell	Piddletown	2·65	1·59	2·33	3·33	1·46	1·20	2·17	3·03	4·13	3·11	·66	6·99
W. Symes	Portisham	2·32	1·09	2·45	2·87	1·16	1·54	..	..	..	..	..	..
C. Smith	Portland Bill, High Lighthouse	1·30	·75	3·28	2·63	1·07	·57	1·72	2·00	3·36	3·26	·37	3·40
Rev. W. R. Waugh	,, Chesil	2·10	1·11	2·18	2·95	·84	·77	1·60	2·24	2·86	3·30	·33	3·74
Miss L. M. Harris	Shaftesbury	3·07	1·48	3·32	1·90	1·28	·99	1·52	2·36	3·12	2·85	·54	5·94
T. Turton	Sherborne Castle	3·22	1·31	2·13	2·63	1·92	·94	2·64	2·00	2·94	2·29	·87	6·15
S. Creed	,, Coombe Farm	3·63	1·57	3·07	2·73	1·80	1·18	2·94	2·57	3·03	2·56	1·01	7·22
Rear-Admiral Stopford ..	Shroton	2·41	1·68	2·32	2·57	1·55	1·02	1·25	2·95	3·56	2·53	·86	5·90
Rev. J. Cross	Sturminster Marshall, Bailie House ..	2·28	1·80	2·18	2·65	1·09	1·58	2·05	2·17	4·24	2·66	·58	4·96
Rev. H. Pix	Swanage	1·56	2·37	2·90	2·66	·62	·99	1·77	2·44	3·25	3·80	·70	4·29
H. B. Vincent	,, Victoria Hotel	1·41	2·30	2·72	2·63	·58	·90	1·74	2·26	3·01	3·42	·57	4·12
W. R. Fryer	Verwood Manor	2·31	2·08	2·62	2·81	1·28	1·74	1·86	1·96	3·19	3·05	·57	5·24
S. W. Bennett	Wareham	2·04	1·91	2·50	3·00	·80	1·14	1·68	2·26	3·83	2·82	·57	5·30
I. J. Brown	Weymouth, Nothe	1·95	·97	2·04	2·42	·85	·79	1·92	2·34	3·21	3·19	·38	3·96
Dr. G. H. Batterbury ..	Wimborne, Codford	2·44	2·51	2·89	2·55	1·22	2·38	2·02	2·29	3·86	3·15	·58	4·90
R. B. White	Winterbourne Herringston	2·44	1·33	2·50	3·93	1·17	1·19	2·66	3·69	4·20	3·94	·37	5·94
Rev. H. H. T. Bassett ..	,, Houghton Rectory ..	2·73	1·84	2·08	3·07	1·48	1·66	1·61	2·69	4·72	2·62	·68	5·92
H. Stilwell	,, Steepleton Manor .	2·68	1·53	2·65	3·27	1·31	1·15	2·79	2·74	4·34	4·52	·64	6·86
J. C. Mansel-Pleydell ..	,, Whitchurch, Whatcombe	2·43	1·56	2·35	3·10	1·23	1·93	1·70	2·51	5·19	2·61	·82	5·71
Mrs. Pretor	Wyke Regis, Belfield House	2·11	1·30	2·27	2·62	·99	·81	2·20	2·67	3·48	3·72	·43	4·46
	DEVON.												
C. Grover	Rousdon	3·22	1·27	2·60	3·33	1·47	2·15	2·77	1·69	3·73	2·87	·67	6·41

Table II.—Rainfall in 1901.

Station.	Total.	Greatest fall in 24 hours. Depth.	Greatest fall in 24 hours. Date.	Days of 1in. or more.	Days of ·01in. only.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	In.	In.																
*Abbotsbury, New Barn	27·94	1·65	Aug. 14	3	12	17	10	16	18	6	11	8	10	13	18	7	18	152
*Beaminster, Fleet Street	35·80	1·91	Sept. 16	5	11	17	10	13	15	7	9	10	11	16	14	7	18	147
* ,, Vicarage	36·96	1·96	,,	5	9	18	10	13	16	8	8	11	11	14	15	8	18	150
*Bere Regis Vicarage	29·14	1·38	,, 20	3	14	19	9	16	15	6	10	9	9	14	15	5	17	144
Bloxworth Rectory	30·17	1·31	Aug. 14	3	..	..	..	..	..	..	..	..	..	..	..	..	..	137
Bridport, Coneygar Hill	34·97	2·05	Sept. 16	5	3	15	5	12	14	8	9	9	8	14	13	4	19	130
Broadwindsor Vicarage	36·77	2·18	Dec. 28	5	..	17	7	14	16	5	10	8	10	..	16	4	18	..
* ,, Blackdown House	39·33	2·07	,,	5	18	20	11	16	16	9	11	8	11	18	17	6	24	167
*Buckhorn Weston Rectory	26·41	1·30	Sept. 16	2	18	23	11	18	16	7	9	9	13	13	14	5	20	158
Cattistock Lodge	39·23	1·93	,,	6	4	20	9	18	16	6	11	13	6	15	15	5	17	151
*Chalbury Rectory	28·35	1·71	Aug. 14	2	10	16	7	17	15	7	8	9	9	13	18	4	18	141
Cheddington Court	36·78	2·04	Dec. 28	..	..	13	6	14	15	6	9	9	10	15	16	6	19	138
*Chickerell, Montevideo	26·80	1·84	Aug. 14	3	25	17	8	17	17	6	11	9	10	15	18	9	18	155
,, Rectory	24·77	1·88	,,	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dorchester Waterworks	30·53	2·10	,,	2	4	18	8	16	16	7	11	10	11	12	15	7	17	148
* ,, Wollaston House	30·78	2·40	,,	2	14	18	7	17	17	8	10	10	12	12	15	8	18	152
*East Stoke, Binnegar Hall	29·68	1·75	Sept. 20	3	14	17	8	17	15	7	10	8	9	11	18	9	17	146
*Fleet House	26·65	2·06	Aug. 14	3	11	13	7	16	17	6	9	9	8	11	16	6	17	135
*Gillingham	26·99	1·37	Sept. 16	2	19	20	12	16	16	6	9	9	11	12	15	9	21	156
Holwell, Westrow	32·04	1·35	,,	3	2	13	8	..	15	8	9	6	8	13	12	4	20	..
*Horton Vicarage	29·97	1·81	Aug. 14	3	14	18	9	16	16	7	9	9	8	12	17	4	17	142
Lulworth, West, Vicarage	30·74	1·55	July 28 / Aug. 14	5	6	21	9	15	11	6	8	7	7	10	15	5	17	131
*Lyme Regis, Colway Cottage	31·53	1·70	Sept. 16	5	24	23	10	16	16	8	10	7	11	17	17	8	23	166
Melbury Sampford	35·16	1·65	,,	5	5	11	5	14	15	6	7	9	9	13	10	5	15	119

Table II (continued).

Station.	Total.	Greatest fall in 24 hours. Depth.	Date.	Days of 1in. or more.	Days of ·01in. only.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	In.	In.																
*Parkstone, Heatherlands	28·39	1·30	Aug. 14	2	29	21	12	20	16	6	10	7	9	14	21	10	20	166
,, Poole Road, Ben Hin	..	1·35	,,	..	..	..	..	..	..	..	..	6	8	13	15	7	20	..
Piddletown	32·65	2·34	,,	2	2	17	7	14	12	5	8	8	7	10	11	5	19	123
Portisham	..	..	..	..	..	18	8	19	17	6	10	..	..	..	..	..	..	..
*Portland Bill, High Lighthouse	23·71	1·65	Aug. 14	2	27	16	9	19	17	7	8	9	9	15	19	8	21	157
* ,, Chesil	24·02	1·85	,,	4	23	19	10	17	15	6	7	8	10	14	18	6	13	143
*Shaftesbury	28·37	1·32	Sept. 16	2	24	23	11	17	17	7	9	8	11	15	19	9	22	168
*Sherborne Castle	29·04	1·31	,,	4	18	23	8	16	15	8	10	11	12	14	18	11	21	167
* ,, Coombe Farm	33·31	1·48	,,	4	13	22	9	17	14	7	9	10	11	17	15	7	20	158
*Shroton	28·60	2·00	Aug. 14	2	8	17	8	15	13	7	9	8	10	14	13	5	20	139
*Sturminster Marshall, Bailie House	28·24	1·44	,,	3	12	20	7	15	15	7	9	10	9	15	17	5	18	147
Swanage	27·35	1·27	,,	2	2	15	9	14	15	5	9	6	10	11	19	7	17	137
* ,, Victoria Hotel	25·66	1·25	,,	2	11	15	8	15	15	5	8	6	9	11	20	6	17	135
Verwood Manor	28·71	1·26	,,	1	7	18	10	16	16	7	9	9	7	13	17	4	18	144
*Wareham	27·85	1·47	,,	2	16	17	8	17	15	6	10	8	10	14	18	9	18	150
Weymouth, Nothe	24·02	1·84	,,	2	4	17	7	15	15	5	9	8	8	12	16	6	17	135
*Wimborne, Codford	30·79	1·41	,,	3	17	23	11	21	15	9	8	9	10	14	20	12	21	173
*Winterbourne Herringston	33·36	2·90	,,	2	8	15	5	17	16	6	10	9	9	11	16	5	18	137
,, Houghton Rectory	31·10	1·87	,,	2	6	15	7	15	14	8	10	8	8	11	14	4	19	133
* ,, Steepleton Manor	34·48	2·10	,,	4	22	21	10	18	17	6	10	10	10	13	14	9	17	155
* ,, Whitchurch, Whatcombe	31·14	1·52	,,	3	15	21	9	17	16	8	9	8	10	14	17	9	21	159
Wyke Regis, Belfield House	27·06	2·13	,,	2	4	15	8	16	16	5	9	7	7	14	17	6	18	138
Devon.																		
Rousdon	32·18	1·78	Sept. 16	5	5	20	10	16	15	8	9	8	10	15	17	8	21	157

TABLE III.—Average Monthly Rainfall.

	1901.				46 years, 1856-1901.		
	Average of 44 Stations.	Proportionate fall (*a*). Difference from 46 years average (*b*).		Days of ·01in. or more.		Proportionate fall (*c*). Do. corrected for inequality of days (*d*).	
	In.	(*a*).	(*b*).		In.	(*c*).	(*d*).
January ..	2·538	84	−14	19	3·306	982	965
February	1·603	53	−23	9	2·544	756	815
March ..	2·651	87	+19	17	2·299	683	671
April ..	2·952	97	+31	16	2·237	665	673
May ..	1·324	44	−14	7	1·965	584	574
June ..	1·277	42	−24	9	2·212	658	667
July ..	2·200	73	+ 3	9	2·345	697	684
August ..	2·420	80	+ 2	10	2·631	782	768
September	3 837	126	+34	14	3·098	921	935
October ..	3·133	103	−13	17	3·901	1159	1138
November	·663	22	−83	7	3·520	1046	1062
December	5·750	189	+82	19	3·590	1067	1048
Year ..	30·348	1000		153	33·638	10000	10000

TABLE IV.—STATISTICS OF THE TEMPERATURE OF THE AIR, AND OF THE HUMIDITY AND AMOUNT OF CLOUD AT WINTERBOURNE STEEPLETON MANOR AT 9 A.M., FORWARDED BY MR. H. STILWELL.

	Temperature of the Air.							Humidity. Saturation = 100.	Cloud. Overcast = 10.
	In Stevenson Screen.					On Grass.			
	Average of			Extremes.					
	Highest.	Lowest.	Daily.	Highest.	Lowest.	Average Lowest.	Lowest.		
	°	°	°	°	°	°	°		
January ..	44·2	32·9	38·8	51·9	12·0	30·4	16·3*	90	7·5
February ..	41·7	30·2	36·0	48·4	21·0	26·9	15·1	85	7·3
March ..	45·2	33·7	39·3	55·3	20·8	30·8	15·0	82	7·8
April	54·9	37·7	45·9	69·8	27·0	33·9	21·8	77	5·1
May	62·5	40·8	51·0	71·3	30·5	35·9	24·9	73	4·5
June	64·0	48·2	55·5	76·8	38·0	43·7	30·9	75	6·9
July	72·1	53·6	62·2	82·5	44·0	48·4	37·5	77	5·0
August ..	69·0	51·0	59·5	78·1	43·2	45·5	37·2	78	5·7
September ..	63·6	50·1	56·5	69·0	38·2	44·2	29·2	85	7·6
October ..	56·8	42·3	49·3	67·0	29·6	37·3	24·9	90	8·1
November ..	48·2	33·5	40·9	55·7	19·8	28·6	14·0	85	6·3
December ..	45·0	33·4	39·4	53·0	18·8	28·9	13·5	88	6·2
Year	55·6	40·6	47·9	82·5	12·0	36·2	13·5	82	6·5

* Thermometer on grass covered with snow.

Creechbarrow:
An Essay in Purbeck Geology.

By W. H. HUDLESTON, M.A., F.R.S., F.G.S.

Part I.

GENERAL DESCRIPTION AND STRATIGRAPHY.

A *HISTORY of the Subject.*—Those whose good fortune it is to dwell in the Vale of Wareham are familiar with the elegant outline of Creechbarrow, standing forward, as it does, like a sentinel in front of the long Chalk range which divides the Isle of Purbeck into two very dissimilar portions. It is with the northern portion of the Isle of Purbeck only that we are concerned in the present instance, and Creechbarrow may be regarded as its dominating feature. The aspect of this hill is somewhat volcanic in outline, presenting from certain points of view the appearance of a perfect cone, which only requires an eddying dust or a furze fire in full blaze in order to be taken for an active volcano.

Irrespective of its true physical structure, which we shall proceed to consider presently, such a hill is bound to have a history. Thus there are on, or near, the summit two very different indications of human agency. One of these is a tumulus built up mainly of very large flints, which has apparently been opened years ago and diligently rifled. That Creechbarrow should have had its tumulus is only natural, and we may well believe that the remains of some chief of the Durotriges reposed there for centuries before the archæologist unearthed them.

On the actual summit there are the foundations of a building of some size and considerable strength, together with indications of enclosures further down the sides of the hill. The summit seems to have been prepared for this building, and the quantity of Purbeck and other stone renders the superficial indications of this part of the hill untrustworthy for geological interpretation. Authorities may perhaps differ as to what sort of a building these foundations actually supported; but I find in * Treswell's map of the Isle of Purbeck a picture of "Creechbarrow Lodge," indicating a tower (with a door and two windows above the door) perched on the summit of a conical hill in the midst of several deer, which are represented as ranging the wilderness between it and "Stowboro." The authors of the third edition of Hutchins' "History of Dorset" † remark that a similar erection, to which the same name is attached, is exhibited in an old map of the county engraved in 1575. They also further observe that Hutchins, in speaking of Creechbarrow, says that the ruins of the principal lodge of the Isle and Forest of Purbeck are still visible on the top. This was presumably in 1773. In the interval between the first and third editions

---

* Drawn about A.D. 1585-6 and preserved at Kingston Lacy. See Hutchins' "History of Dorset," 3rd ed., Vol. I., p. 462.

† Vol. cit., p. 606.

of Hutchins' work (1773–1861) the ostensible ruins had disappeared, but we may be allowed to suppose that the foundations now existing formed part of the original tower. Anyhow, in the 16th century there was a keeper's lodge on the summit of Creechbarrow, and no long dogs could run the deer in the daytime without the keeper seeing them during the reign of Elizabeth.

In Hutchins' "History of Dorset" the resemblance of Creechbarrow to a volcano is noted; but, of course, this resemblance is merely superficial, and indeed, when we study the topography of the hill closely, we scarcely need the aid of geology to perceive that its origin is altogether different. At the same time there are many features in connection with Creechbarrow that are to a geologist exceedingly difficult to account for, and it will be my object in this memoir to offer an explanation based mainly upon recent discoveries.

The members of the Dorset Field Club will not forget that we had a very pleasant excursion to West Purbeck on the 21st August, 1901, when I offered some remarks respecting the possible origin of Creechbarrow, which were published in the volume of the "Proceedings" for last year. It was especially pointed out as being one great peculiarity of Creechbarrow that, although composed entirely of Tertiary Beds, it attains an elevation considerably exceeding that of any other Tertiary Beds in the immediate vicinity, and almost rivals the Chalk of the Purbeck Hill in altitude. There was no difficulty in realising this peculiarity at the time of the excursion, since we had the map of Nature before us, but, in order to bring the matter more fully home to the members of the Field Club, I reproduce a diagramatic sketch of the Trough of Wareham, which has already appeared in the "Geological Magazine."*

---

* Decade IV., Vol. IX., No. 456, p. 241, June, 1902. It is intended to incorporate the bulk of the above quoted article with the present communication to the "Proceedings" of the Dorset Field Club.

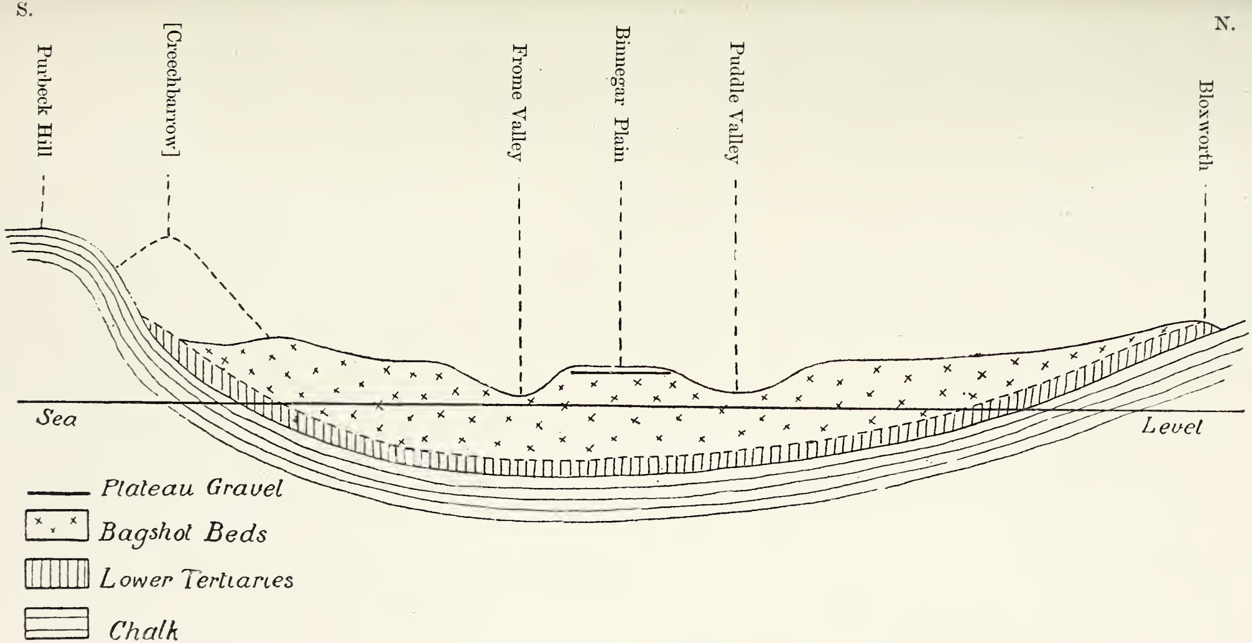


Fig. 1.—The Trough of Wareham.

Note.—If this diagram were continued in a northerly direction it would be found that the Chalk ultimately rises in the Dorset Downs to heights considerably exceeding that of the Purbeck Hill, thus completing the figure of the great Dorset syncline.

This diagram, which has a horizontal extension of about eight miles from south to north, is intended to represent the *general* topographical and geological structure of the Trough of Wareham on a meridian both east and west of Creechbarrow. The section itself may be taken more particularly to represent a meridional line to the westward of that hill drawn through West Creech, Binnegar, and Bere Heath. Accurate detail is not attempted, but the thoroughly exceptional character of Creechbarrow can be gathered from the dotted outline of the hill itself, projected on the section. We perceive at a glance that the Tertiary beds in this hill are just twice as high above sea level as they are in the *normal* or *general* section between the Purbeck Hill and the Frome River. The latter is the northern boundary of the Isle of Purbeck.

The general structure of the Trough of Wareham is no doubt that of an undulating syncline, but owing to the softness of the Bagshot Beds accurate stratigraphy is not attainable. I am inclined to believe that the original bottom of the syncline is represented by the Plateau-gravel on Binnegar Plain, and that both the Frome and Puddle Valleys have been excavated subsequently.

Having thus impressed upon the meeting the thoroughly exceptional character of Creechbarrow in its relation to the rest of the Tertiary beds in the neighbourhood, I next endeavoured to adduce some reasons for the explanation of this anomaly. Premising that hills, as we see them now, are the outcome of certain elevating forces of a remote period, and that they have been fashioned by meteoric agencies, which themselves are modified by various internal and external peculiarities, I offered three possible suggestions or theories to account for the existence of Creechbarrow as we now see it, and for its exceptional relation to the Bagshot Beds of the immediate district, which largely consist of potter's clays of different qualities (the Pipeclay beds).

The details of these "three possible suggestions or theories" have already appeared in the Volume for last year (Vol. XXII.), and there is no need to enlarge upon this subject beyond pointing out that subsequent experience has shown the first of these suggestions, viz., "the exceptional development of the Creechbarrow beds themselves," to have been the most correct. It will be remembered that, in conclusion, I pointed out the only way to ascertain the true structure of Creechbarrow would be to drive a horizontal level into the hillside so as to set all doubt as to its composition at rest.

Investigation of the Summit.—With the hearty concurrence of Mr. Nathaniel Bond, and with the consent of the occupier, I set some men to work digging in October, 1901, and we very soon arrived at most unexpected results. The remarkable greensward on the very summit of Creechbarrow, so different to the vegetation of the typical Bagshot districts, where heather and Iceland moss afford a meagre diet to the rabbits, had always provoked my suspicions. No one, however, had ever suspected that the actual summit of Creechbarrow consists of LIMESTONE, but now we perceive that the calcareous nature of the soil is chiefly accountable for this unwonted greenery at such an elevation.

Altogether some seven or eight pits were dug within the limits of the 600 feet contour. The first pit (No. 8*a*) * was dug in the eastern flank of the summit ridge, some distance below the actual summit. Here a calcareous talus was encountered before the solid geology of the hill was reached. This calcareous talus created great surprise, and many were the conjectures as to its origin. The material was mainly in a chalky condition, and as there were no fossils to guide us we concluded that some chalk had been brought up to the top of

* These figures refer to the numbering ultimately adopted.

the hill. Then, again, remembering that the foundations of the house formerly existing on the summit consisted of dressed Purbeck stone, we fancied that a sufficient quantity of Purbeck stone might have slipped down to form a talus—and this seemed the more probable, as the less perished stones had rather the look of a fresh-water limestone : so the theory of a Purbeck, or even a Portland origin, prevailed over the original supposition of derivation from the Chalk. At that stage of the investigation we never dreamt of an autochthonous deposit of limestone on the hill itself. When the calcareous talus was penetrated in this section, we found the solid geology to consist of a peculiar cakey sand, passing down into buff-coloured sands with vertical tubes having a calcareous lining. Underneath this was an irregular layer of flints, some of great size, about a foot thick, and, lower still, loose white sand, preceded by yellow sandy clay blotched with oxide of manganese and containing perished flints.

So far as I know, these yellow manganese-stained sands and clays, in conjunction with the flint beds and the concretionary limestone subsequently discovered, make up the hill-top of Creechbarrow—that is to say, of the area within the 600 feet contour, some three or four acres in extent. Since the source of the limestone fragments in the talus had not yet been discovered, we made an excavation a few feet higher up (No. 8), and there we had the satisfaction of detecting a massive tufaceous limestone with an irregular surface passing downwards into sand with calcareous concretions, and this excavation was carried down to a layer of flints which was not pierced. Whether this is the same as the layer in the lower pit one cannot say.

Before proceeding to describe the complete discovery of the limestone, I will draw attention to the problem suggested by the flints. It will be remembered that, when in August last I offered

three possible suggestions as to the origin of Creechbarrow, I laid considerable stress on the abundance of flints knocking about over the hill as evidence of the former existence of plateau-gravel upon or near the summit. It was now proved that these large and peculiar flints which one associates with Creechbarrow are not by any means derived from any superficial deposit, but that they constitute an important part of the beds of which the hill is composed. These beds are undoubtedly of Lower Tertiary Age, and, if we assume, in default of evidence to the contrary, that they are of Bagshot Age, at least these flint beds constitute a portion of the series, whatever it may be. But, in order not to prejudge the question of age, I will simply speak of the whole series as the *Creechbarrow Beds.*

In describing certain sections further on, the subject of these bedded flints will again crop up, but we may note some peculiarities with reference to them now. It must always be borne in mind that these flints are large stones in the midst of extremely fine sediments. There are, no doubt, throughout the Creechbarrow Beds, as elsewhere in the Bagshots, coarse iron-grits and lydite gravels, such as the people in the neighbourhood call "granite gravel." Still, the bulk of the deposits, whether of sand or clay, are of fine material, and yet these large flints occur in abundance, not only disseminated occasionally through the clays and sands, but accumulated in beds of varying development up to 4 feet in thickness. For a more detailed description of these flints I must refer to Part II., p. 178.

Having ascertained the undoubted existence of indigenous limestone on Creechbarrow, it became necessary to obtain some further knowledge both of its mode of occurrence and general character. Pits were opened in one or two places, and especially on the summit. Before proceeding to describe the summit pit (No. 5) I will submit the section of No. 4 pit, which is on the south slope of the actual summit and forms part of the escarpment (see Fig. 7, p. 176).

The following sequence was observed (No. 4 pit):—

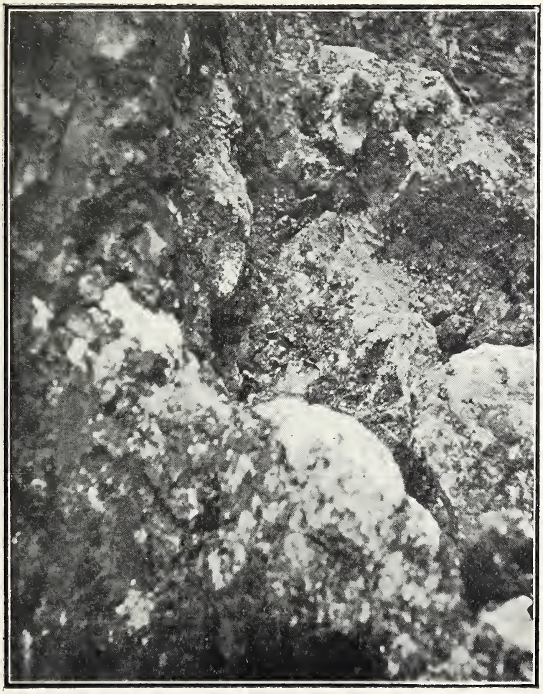
		FT.	IN.
1.	Soil with few flints, fragments of pottery, oyster shells, &c. ..	1	6
	N.B.—A deposit of this nature forms a sort of talus to the whole section on the hill-side.*		
2.	Softish tufaceous limestone	2	6
3.	Passing downwards into sands full of calcareous concretions ..	4	0
4.	Band of yellow clayey sand	0	6
5.	Loose buff-coloured sands	5	10
6.	Layer of large flints of the Creechbarrow type	1	0
7.	Pale buff-coloured sands (not buttomed)	4	0
	Total ..	19	4

For convenience this section was cut in three steps. It was here that the principal evidence for dip was obtained. No bedding was observable in the tufaceous limestone, and the irregular nature of its base causes it to be of little use for stratigraphical purposes. The thin band of "yellow clayey sand" was more useful, and also the "flint layers," so that from these and other indications an inclination of 9 inches in 48 inches was observed, the direction being somewhat to the west of north, or at any rate northerly. This may be calculated into an incline of 1 in 5·5 = 11° nearly. The identification of the particular flint band in another pit, supposing such identification to be correct, serves to confirm the amount of dip and also the direction. The longer axis of the hill itself runs in a direction about N.N.E., being nearly at right angles to the trend of the long Purbeck Hill, and this peculiar conformation is especially noticeable from many points in the Frome Valley. The great bulge which the Creechbarrow beds impress upon the

* As regards these deposits in the soil and in the semi-artificial talus, I have the following note:—Black soil with pottery, oysters, limpets, mussels, periwinkles, bones, fragments of Purbeck stone (dressed), iron sand, pieces of the hill limestone, old pipes, &c.

Pipeclay series has the same direction as the longer axis of the hill. Hence the observed dip and the dip slope (see Fig. 3) are slightly divergent. On the whole, without attempting an accuracy which in beds of this character is practically impossible, we may say that the Creechbarrow Beds, as determined from indications near the summit, have a dip to the northwards of from 10° to 12°.

A



B

FIG. 2.—THE SUMMIT PIT (No. 5). FROM A PHOTOGRAPH BY MRS. HUDLESTON.

A. Solid concretionary limestone *in situ*.

B. Artificial rubble, mainly derived from the limestone.

The vertical section, as shown in Fig. 2, is about 7 feet.

The summit has been artificially flattened, and certain courses of Purbeck stone (dressed) remain as evidence of the foundations of the keeper's lodge which formerly occupied this site. About a foot or eighteen inches below this we came upon a section which is partly natural and partly artificial. The natural portion consists of solid tufaceous limestone, showing certain irregular divisions, but nothing that could be referred to bedding; the jointing is in all directions with possibly a tendency to the vertical. Alongside of this mass of natural limestone is a miscellaneous rubble of artificial origin. The upper portion consists of small calcareous rubble mixed with sand, flints, &c., down to a line of black earth. Below this is a conglomeration of looser stones, where flints and large blocks of tufaceous limestone may be noted. The whole probably rests on tufaceous limestone *in sitû* lower down.

Situated on the very top of Creechbarrow, this section is very suggestive. That the summit has been artificially flattened for the purpose of supporting a structure is evident. At what period this was *first of all* done it is impossible to say, but we are justified in supposing that, before human interference with such a prominent feature of the landscape, the limestone rock stood out like a needle or tooth above the encompassing greensward. Being too precipitous in its natural state to support a building, masses of the original summit have been cut away and used in forming the strange medley of rubble which is seen on the right of the section. We perceive, indeed, the very fragments of limestone that have been detached so as to make a platform on which to build. The foundations are thus partly natural and partly artificial.

This limestone forms the summit of Creechbarrow, and it is terminated towards the south by what may be deemed an escarpment (see Fig. 7). We can follow it on the dip towards the north, though its lateral extension east and west of the immediate summit is certainly restricted, but the elongated shape of the summit ridge is undoubtedly determined by this

very hard rock. About 120 feet N.N.E. of the summit, in the direction of the dip slope, we sank another pit (No. 6) and came upon a very interesting section. The hard nodular limestone is here found to form a very rough and irregular surface beneath a peculiar deposit which has a depth of from 3 to 5 feet, according to the inequalities of the limestone. About 100 feet from this, in a N.N.W. direction and just within the 600 feet contour, we found this same peculiar deposit, quite 6 feet thick, resting on the irregular surface of the tufaceous limestone, here apparently undergoing a softening process.

The Deposit on the Creechbarrow Limestone.—Of the many enigmas which this curious hill presents to the puzzled geologist there are none more difficult to solve than the true nature and origin of the deposit which, from a geological point of view, is the highest in the sequence, although so irregularly distributed that it has not been indicated on the dip slope section (Fig. 3). The upper portion of the deposit, in places, consists of a mass of rounded and sub-angular flints in a muddy matrix, passing downwards into a stiff yellow clay with much black oxide of manganese, and a variable assortment of large and small flints, flint pebbles, and other stones, disposed after the manner of drift. At present I must be content to state the facts about this deposit as I find them, without attempting any explanation. In the detailed "northern section," described a little further on, the beds from *a* to *d* represent this deposit in position, if not in character, being situated above the limestone. That both this peculiar deposit and also the beds in the above-mentioned section are really part of the Creechbarrow series, and not a surface drift, can hardly be doubted.

We must now endeavour to trace the limestone (*a* of Fig. 3) on the dip slope to the point where it disappears. Omitting any indication of the peculiar deposit mentioned above, Fig. 3

is a rough superficial section from the summit of Creechbarrow (637 feet) to the sand-pit about the 350 feet contour.

The horizontal distance may be 1,150 feet. The northern spur which we follow is in alignment with the longer axis of the hill, which extends N.N.E. from the summit. It must not be supposed that the calcareous beds have been proved every yard of the way. There are two places on this spur, above the 500 feet contour, where "marl" has been found close to the surface. The highest of these is 250 feet, measured horizontally, from the last pit where we found the hard hill-top limestone. I

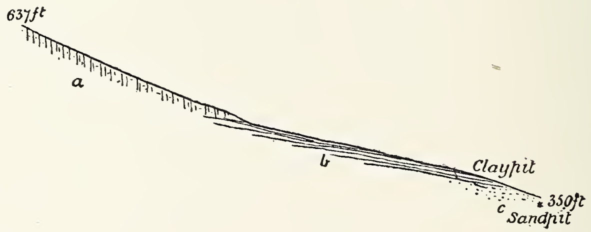


Fig. 3.—The Northern Slope of Creechbarrow.

a. Hill-top, or Creechbarrow limestone. *b.* Brown Clay series.

c. Sands underlying the Brown Clay.

should observe that the term "marl" refers to a softened condition of the limestone, though in most cases it is more impure than the hard limestone of the summit. There is a well-marked bluff about the 500 feet contour, near where the calcareous series terminates, and the following section, derived from a series of trenches which we made in the hillside, shows the nature of the Creechbarrow series at this point. The top of the section just reaches the 500 feet contour.

NORTHERN SECTION.

		FT.	IN.
a.	Surface with tree roots, &c.	3	0
b.	Fine clayey sands with flints..	2	0
c.	Sandy without flints	2	6
d.	Tough yellow clay	2	0
e.	UPPER MARL	1	0
f.	Tough clay	2	6
g.	MAIN MARL	7	0
	N.B.—There is a break here owing to old workings which would add to the marl ..	5	0 ?
h.	Impure marl containing sand—a passage bed ..	3	3
i.	Buff clayey sand	1	6
j.	Flint gravel and sand	1	3
	Total section ..	31	0

This series of beds rests upon a buff-coloured clay.

(*b* of Fig. 3.) Is a very extensive and important deposit, the thickness of which it is not easy to estimate. It can hardly be less than 40 feet thick, and may be more, and constitutes an important feature along the north side of the hill on both sides of the 400 feet contour. In the brick-earth are said to be lenticular masses of sand with flints at the bottom, which to a certain extent detracts from its value for brick and tile-making. The brown clay series, in which Mr. Bond's clay-pit and brick-yard are situated, rests on sands (*c* of Fig. 3), which may be well studied at the "Sand-pit."

Returning for a moment to the limestone (*a* of Fig. 3), it is evident that the face, or bluff, so well marked in the "Northern Section," is not a natural one; everything has the appearance of an extensive open working, presumably for "marl," yet there is no tradition as to any working here; consequently the period must have been sufficiently remote. The continuation of this face westwards, usually near the 500 feet contour, also has an artificial look about it indicative of former workings. One of

the most peculiar circumstances in connection with this case is the total absence of any limestone fragments throughout this long line of presumed old workings. The same remark must also be made as to Creechbarrow generally. Had any limestone fragments been found rolling about, the discovery of the limestone must inevitably have followed. I have searched also in old walls and houses for any trace of this limestone without success. Where stone has been used in these buildings it seems in all cases to be Purbeck stone. Consequently we are faced with the fact that, while flints of the Creechbarrow series abound and are characteristic, no single specimen of the Creechbarrow limestone appears on the surface. Rapid disintegration, when exposed to the atmosphere, can be the only explanation, though, in view of the excessive toughness of the hill-top limestone, this seems all the more extraordinary. There certainly are some peculiarities in these concretionary limestones which we do not fully understand. I mentioned before that in the talus near the summit the limestone was already softened to the consistence of chalk, and now we perceive that in the course of its further descent it passes away altogether as a distinct rock.

The relation of the Creechbarrow Beds to the Pipeclay Series.—It cannot be said that every point in connection with Creechbarrow has been cleared up, and the great problem of all, viz., the stratigraphical relation between the Creechbarrow Beds and the Pipeclay series of recognised Bagshot age, is as yet unsolved. The Creechbarrow Beds undoubtedly press the Pipeclay series towards the N.N.E. An old workman who had long been engaged in clay-digging pointed out to me some time ago that *Creechbarrow bulges all these beds and throws them out of line.* This circumstance is in favour of their being of Bagshot age, and on a lower horizon than the Pipeclay series. Hitherto it has been a matter of exceeding difficulty to ascertain what are the precise stratigraphical relations of the Creechbarrow Beds to

the Pipeclay series, although on the supposition of their being of true Bagshot age one would expect them to pass under the Pipeclay series, or in some unexplained manner abut against them.

This question—viz., the relation of the Creechbarrow Beds to the Pipeclay series, is one which might repay further investigation. It will be seen in the sequel that the possibility of the Creechbarrow Limestone being the local representative of the Bembridge Limestone is partly discussed. The stratigraphy of the hill would to a certain extent be simplified by such a supposition, but there would arise a further difficulty—viz., what other portion of the Creechbarrow Beds should be included as representing the Bembridge series: in other words, where is the line of unconformity to be drawn, supposing there be an unconformity, between the Lower Bagshots and the possible representative of the Bembridge series? Altogether this is too hypothetical a question to be considered at any length in the present essay, which aims at description rather than at attempts to explain the obscurer problems presented by Creechbarrow.

Nevertheless, there is a considerable amount of available information, partly derived from personal observation and partly from borings in search of Pipeclay—the latter chiefly on the north side of the hill. In order, then, to be in a position more fully to grapple with this subject, attention is invited to the accompanying sketch-map of Creechbarrow, which is partly geological and partly topographical. The probable limit of the Pipeclay workings, shown by the curved and dotted line, A′, may have to be considerably modified if the recent borings S.S.E. of Mr. Bond's brickyard, d of the sketch-map, should prove the existence of any notable quantity of Pipeclay in that position (see p. 189).

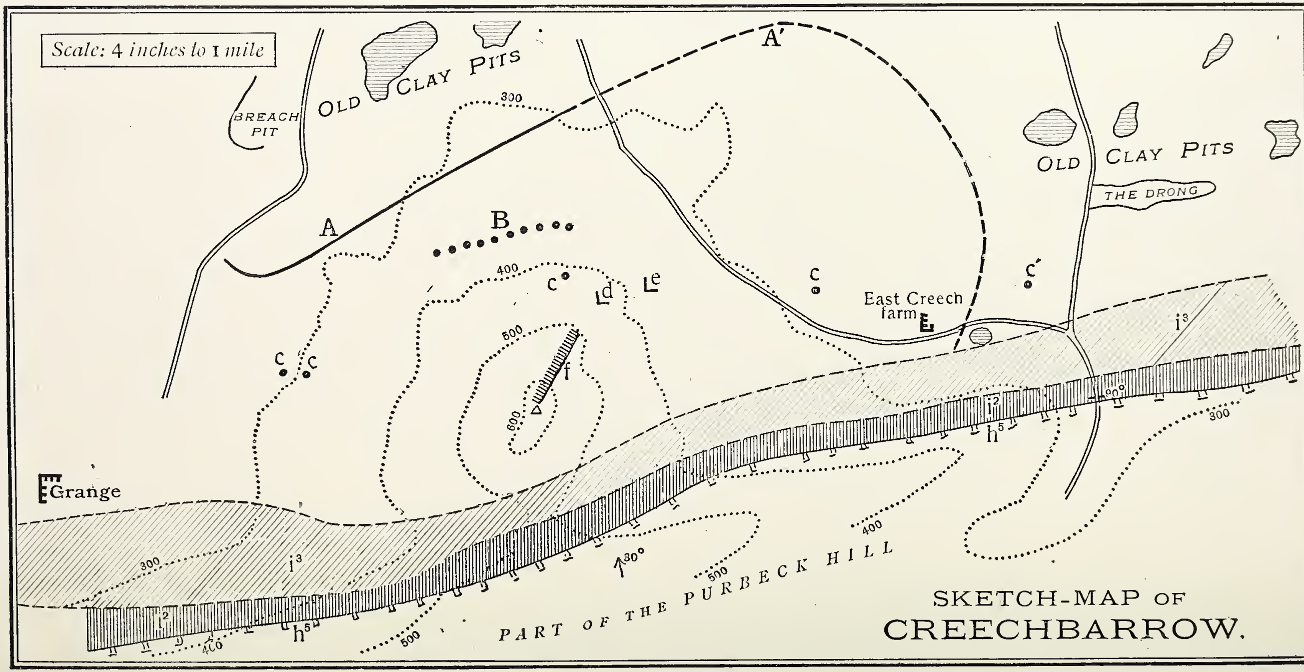

Scale: 4 inches to 1 mile
BREACH PIT
OLD CLAY PITS
OLD CLAY PITS
THE DRONG
A
A′
B
300
400
500
600
c
c′
d
e
f
East Creech farm
Grange
i^3
i^2
h^5
80°
90°
PART OF THE PURBECK HILL
SKETCH-MAP OF
CREECHBARROW.

Fig. 4.

EXPLANATION OF THE SKETCH MAP OF CREECHBARROW.

---

i^3. London Clay.

i^2. Reading Beds.

h^5. Chalk.

A. Actual southern boundary of the Pipeclay workings.

A'. Probable limit of the Pipeclay workings.

B. Indications of Pipeclay at considerable depths, as proved by borings.

c. Borings carried to 150ft. without finding Pipeclay.

c'. Boring where Pipeclay has been proved.

d. Claypit in the Creechbarrow Beds (Mr. Bond's brickyard).

e. Sandpit in the Creechbarrow Beds.

f. Indications of the Creechbarrow Limestone and Marl.

▲. The summit of Creechbarrow—637ft.

N.B. 1.—The "Drong" is a dry claypit in the Bagshot series worked out several years ago, where the beds are curved and tilted at a very high angle. Due south of this the Reading Beds are vertical, as shewn by the position of an ironstone grit on both sides of the road at the point where 90° is marked on the map.

N.B. 2.—Since this map was constructed a borehole is said to have been put down to the south of Mr. Bond's brickyard, which yields some indications of Potter's Clay.

N.B. 3.—It is also stated that, in a borehole on the flat north of Black Hills, brickearth similar to that in Mr. Bond's claypit, d, was found at a depth of 133ft. This also contained flints.

All the area north of the London Clay shown in this sketch map is presumably of Bagshot age, unless we adopt a supposition which will be discussed presently. The point, then, is to ascertain where the Creechbarrow Beds terminate and the Pipeclay Beds begin. To prove this beyond the possibility of error would necessitate the cutting of a very deep trench right through both series—an almost impracticable feat. What the map tells us is that no Pipeclay has hitherto been worked within the curve A A′, whereas outside that curve the old clay-pits tell their own story. One point of considerable importance consists in the fact that, whereas immediately to the east of Creechbarrow the Pipeclay series is found almost in contact with London Clay, and so continues all the way to Corfe Castle, yet to *the west* of this line, in the vicinity of Creechbarrow itself, we find that a distance of several hundred yards separates the London Clay from the Pipeclay, the intervening space being occupied by the Creechbarrow Beds. We can scarcely believe that the whole Creechbarrow series has been faulted out in the area where it is missing, and thus we must fall back on the theory of exceptional development within a limited area if we adopt the Bagshot age of this very peculiar set of beds. We know from Mr. Clement Reid's memoir that the Bagshot Beds west of a certain meridian in the county develop into exceedingly coarse sediments, but there is very little of this kind in Purbeck, excepting the Creechbarrow Beds themselves, which are only of limited extent.

The Evidence afforded by the Bore-hole Sections.—In further studying the sketch map, attention may be drawn to the dotted line, B. This is intended to represent a series of bore-holes which have been made in the undulating ground between Aldermoor and Cotness, mostly at the base of the northern slope of Creechbarrow, and all well below the 400 feet contour. The dotted line does not represent the number or actual position of the several bore-holes, but is intended merely to generalise the position of these bore-holes where Pipeclay has been found to the south of the area actually worked.

Through the courtesy of Mr. Leonard Pike and his manager, Mr. Usher, I have been supplied with the particulars of these bore-holes, which in themselves alone constitute an interesting study. It should be borne in mind that no Pipeclay has been found in the bore-holes above the 400 feet contour, marked c on the plan, and it is between these two sets of bore-holes—viz., those above and those below the 400 feet contour, that the great change appears to take place.

Dealing with the bore-holes below the 400 feet contour, marked generally B on the plan, and omitting one or two outside bore-holes, I have divided them into three groups as follows :—

No. 1 *Group.* (Nos. of bore-holes 121 and 125.)—These are situated between the 400 feet contour and the footpath from Cotness to Grange; *i.e.* to say, on the south side of the footpath and considerably above it. They are about 120 feet apart and exhibit the following sections :—*

		FT.
No. 121.—	x. "Rubbish clay" (? superficial)	14
	a. Sandy series	56
	b. Clay series, including 4 "veins" of white clay ..	105
	c. Second sandy series	10½
		185½

		FT.
No. 125.—	x. Gravel, sand, and loam (? superficial)	29½
	a. Sand	32½
	b. Clay series, including only the upper "vein" of white clay	77½
	c. Second sandy series	57
		196½

Although no more than 120 feet apart, the difference in these two bore-holes is already great, though it is just possible that part of the difference may arise from misunderstanding work-

* The full particulars of the borings, including workmen's terms, may possibly form the subject of another communication.

men's terms. There is a very considerable thickness of local drift accumulated on the northern platform from which Creechbarrow springs up, and I consider that the top "rubbish clay" of No. 121 is probably a gravelly clay, such as one sees in abundance about this elevation, which is the equivalent of the "gravel sand and loam" of No. 125.

No. 2 Group. (Nos. of bore-holes, 119, 114, 115, 116, 117.)—These are in alignment just to the south of the footpath from Cotness to Grange at elevations ranging from about 340 feet to 360 feet above O. D. The distance from one extreme to the other is about 600 feet in a line running approximately from east to west. Of these five bore-holes I select No. 115 as affording a representative section. The mouth of the bore-hole is 357 feet above O. D., and the bottom of the "good clay" is 191 feet above O. D.

		FT.
No. 115.—x.	Gravel	7
a.	Sandy series with stone	12
b.	Clay series with two beds of white clay	73
c.	Second sandy series	60½
d.	Second clay series with 6ft. "Good clay" ..	13
e.	Third sandy series	10
		175½

The sections in this group, on the whole, correspond with each other better than is the case in No. 1 Group. There is a considerable difference in the thickness and character of the superficial beds, but the alternate clays and sands of the Bagshots are fairly similar. It is by no means certain that the series a. b. and c. are precisely the same as in No. 1 Group. This lettering is only adopted as some attempt at classification.

No. 3 Group. (Nos. of bore-holes 113, 118, 120.)—These bore-holes are north of the footpath, and on the southern slope of the Cotness ridge, facing the northern slope of Creechbarrow. The bore-hole on the left (No. 113) is close to the line of present workings and exhibits a favourable section, as the argillaceous series is here near the surface and contains plenty of white clay.

On the other hand Nos. 118 and 120 exhibit sections in marked contrast to the above. Each of these three bore-holes has been carried down about 150 feet.

I have dwelt on these bore-hole sections at some length in the hope that they might throw some light on the stratigraphical relations between the Creechbarrow Beds on the hill-top and these Pipeclays lower down, if indeed there are any stratigraphical relations beyond a mere jumble of irregular deposits, whose precise orientation can never be disentangled. Whether this latter supposition is the true one or not, the exceptional character of the Creechbarrow Beds, as a local feature, remains the same, even although we cannot decide whether they go under, over, or into the Pipeclay series. Before attempting any further speculation as to the possible stratigraphy of the region I will call attention, at any rate, to its topography as shown in the accompanying figure.

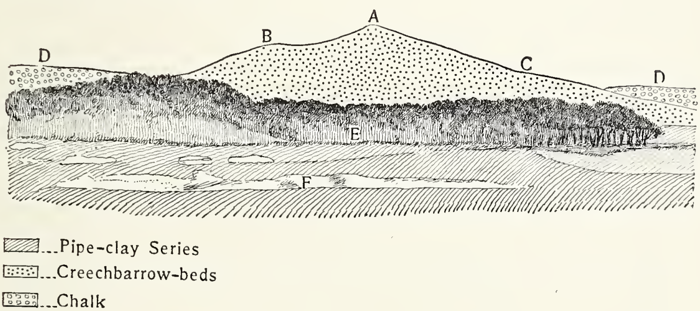


FIG. 5.—CREECHBARROW FROM THE NORTH-EAST BASED ON A PHOTOGRAPH BY THE LATE MR. LAURENCE PIKE.

A. Summit of Creechbarrow—637 feet.

B. The eastern spur.

C. The northern ridge (approximate dip slope).

N.B.—The hill-top limestone extends along this ridge as far as the 500 feet contour.

DD. The Purbeck Hill: Maximum elevation 654 feet, just behind Creechbarrow.

E. Blackhills Plantation, about the 300 feet contour.

F. Spoil-heaps of the clay workings.

North-east Side of Creechbarrow: Additional Particulars as to the Creechbarrow Beds.—From the above figure the *topographical* relations of the Creechbarrow Beds to the Pipeclay series can be seen at a glance; the former looks down upon the latter. It is scarcely necessary to point out that the Purbeck Hill (DD), consisting of Chalk, is depressed by perspective, the highest part of it slightly exceeding the height of Creechbarrow. A word as to the composition of the Creechbarrow Beds seen in this figure may be useful as a sort of recapitulation of what has already been stated. If I give this in the form of a generalised vertical section, it is merely for the sake of convenience, and not to be regarded as absolutely true at any one point.

1. The highest bed of the series is "The Deposit on the Creechbarrow Limestone," already described on page 157. With this must be associated the beds above the "marl" detailed in the northern section, page 159. The thickness of these latter beds is about 13 feet down to the "main marl," and they consist of sands, clays, flints, and a thin bed of "marl."

2. The next in downward succession is the hill-top, or Creechbarrow Limestone, which is excessively hard at the summit (A), but becomes softer when traced on the dip slope towards the 500 feet contour (the letter C is approximate); in this condition it is known as "marl," and may be about 12 feet thick in some places.

3. The beds immediately *below* the Creechbarrow Limestone are extremely variable and constitute a stratigraphical crux of considerable perplexity. They certainly differ materially within short distances, and but little analogy can be traced between those on the south side of the summit and those on the north side, which are below the 500 feet contour. On the south side of the summit these beds have been traced in detail with considerable accuracy for about 20 feet vertical (see section of No. 4 pit, p. 154), and this must be regarded as the standard section.

It is probable that the flint bed of No. 4 pit is the same as the flint bed in No. 9*a*, which is about 33 feet below the summit and

to the west of it;* but in this latter pit the flint band is 2 feet thick and contains some very large flints. The associated sands also contain an occasional flint. On the whole, we may sum up by stating that the beds immediately below the summit Limestone, for a vertical extent of perhaps 30 feet or more, are sandy, with some yellow clay, frequently manganiferous, and are characterised by numerous beds of flints, the beds ranging from 6 inches to 3 feet 6 inches in thickness; loose flints also occur in the sands.

In further illustration of this class of beds I would direct attention to the eastern spur of Creechbarrow (B of Fig. 5). This spur is a conspicuous object from the north-east side, since it breaks the regularity of the conical outline as seen from Furzebrook.

Being desirous of finding some evidence as to the cause of this slight local prominence, I had a special pit sunk on the very top of it with the following result:—

PIT ON THE EASTERN SPUR OF CREECHBARROW.

	FT.	IN.
a. Sandy earth with flints	0	6
b. Flint gravel	3	6
c. Buff, ferruginous sand with manganese nodules	2	6
Total section	6	6

The flint-gravel (b) of this section is the thickest deposit of the peculiar "gravel" of Tertiary Age as yet discovered on Creechbarrow; water was lying in the bottom of the pit, apparently due to a pan formed by surface action. The extent of the opening scarcely permitted us to ascertain whether there

* These numbers refer to a plan of the pits which was made for convenience, but which was not considered of sufficient importance for publication.

is any bedding in the "gravel." The stones are of very unequal size, varying from flints 30lb. in weight to quite small stones; I did not at the time notice any pebbles. The character of the flints here is just the same as in all the Creechbarrow Beds; the large ones have a partially rounded exterior consisting of white silica thoroughly degelatinized. Some are degelatinized throughout, others have a brown core of gelatinous silica still left; most of them are very brittle and fly to pieces on being struck by the hammer. At present it is not possible to connect this particular bed of flints with those found in the pits near the summit. That there are beds of flints occurring in stratigraphical relation to the sands and clays of this hill is certain, and they probably occur on several horizons. The manganese nodules in the buff ferruginous sand are very interesting and fairly abundant. I shall refer to them again when dealing with the lithology of the Creechbarrow Beds.

The evidence obtained in this pit on the eastern spur goes to confirm the supposition that the abundance of bedded flints of Tertiary Age in the upper part of Creechbarrow has materially assisted the limestone in preserving the softer sands and clays from denudation. Such an observation may be accepted as a general one, applicable more or less to the whole hill. When we come to particulars the limestone is more especially accountable for the summit (A), whilst the unusual accumulation of flint "gravel" is more directly the cause of the eastern spur (B).

3′. Still dealing with the deposits immediately below the limestone and "marl," we have seen that, on the northern slope and some distance below the 500ft. contour, the calcareous series rest on a few feet of sands with flint gravel, and that below this comes a very important deposit of buff-coloured clay (Mr. Bond's clay pit), which may occur as a lenticular mass, as it does not appear to have any representative if followed in the direction of the eastern spur.

4. The lowest member of what I have termed the Creechbarrow Beds are the "Sands" underlying the buff-coloured clay.

These can be studied at Mr. Bond's sandpit, where the following section may be noted.

CREECH SANDPIT.

		FT.	IN.
a.	Clay with rootlets	1	6
b.	Clay passing into sands; flints occur, especially towards the base (? unconformity)	5	6
c.	Bedded sand	1	3
d.	Yellow clay with large flints at base, and a pink line	1	0
e.	Yellow variegated sandy clay with a few small flints	1	6
f.	Salmon-coloured sand with a black centre line. The colouration probably due to manganese ..	0	3
g.	Very fine white sand with but little true bedding (not bottomed)	9	0
		20	3

N.B.—*a* and *b* represent the base of the Creech brick-earth or buff clay.

This concludes the description of the Creechbarrow Beds, as far as I have been able at present to trace them. If we turn to Figure 5 we perceive that the convenient obscurity afforded by the Blackhills plantation helps to conceal their possible relation to the Pipeclay series ; all we can say is that, topographically speaking, they occupy the higher ground, and that when we get well below the 300ft. contour the Pipeclay series has possession of the surface. It has been mentioned on page 163 that a borehole section in the flat north of the Blackhills has shown brown clay like that of Mr. Bond's clay pit underneath the Pipeclay series. This would confirm the late Mr. Laurence Pike's views as to the infraposition of the Creech brickearth and sands to the regular Pipeclay series.

Contrast Between the Creechbarrow Beds and the Pipeclay Series.—It should be borne in mind that the general development of the Creechbarrow Beds is very different to the Pipeclay series of the Bagshots. The character and composition of the former must be gathered from the previous descriptions, and it may be added that plant remains and carbonaceous matter are rare. On the other hand, the Pipeclay series is remarkable for the rarity of calcareous matter, the excessive fineness of its sediments, free from bedded or scattered flints, the large development of pale clays with admixture of stained or " bloodshot " clays, and the abundance of carbonaceous matter, sometimes with plant impressions and remains.

Further consideration of the Stratigraphy: The " Gully" Theory.—We are now in a position to further consider the stratigraphical question to which I alluded in describing the bore-hole sections (page 167). This must be dealt with rather briefly, since the available material is not very easy to sift. To state the case once more, we are desirous of knowing where and how the junction of the Creechbarrow Beds with the Pipeclay series takes place. This probably occurs beneath the surface of the area between the 300ft. and the 400ft. contours, and not far from the dotted line B. of the sketch map (Fig. 4). I would again direct attention to this sketch map, and for the moment to the "Old Clay Pits" towards the north-west corner, which are on the Grange Road (sometimes called Old Bond Street). The mouth of the old shaft, to which I am about to refer, is situated on the letter " y " of the word " Clay." A line drawn nearly S. from this shaft to the bore-hole No. 115 (situated on the dotted line B.) has a length of about 1,350 feet, measured horizontally. It has been thought that certain observations taken along this line will help to throw some light on the underground stratigraphy. For instance, the bottom of the "good clay" in the "old shaft" has been placed by Mr. Usher at 99 feet above O. D., whilst the bottom of the "good clay" in bore-hole No. 115 is placed at 191 feet above O. D. by the same authority. Hence there is a *mean rise* of 92 feet in 1,350 feet, or 1 in

$14 \cdot 7 = 4^{\circ}$, in a southerly direction. But, on the other hand, according to Mr. Usher, the drainage of the workings and other indications point to a *local fall* for a considerable distance from the mouth of the shaft, also in a southerly direction, as shown by the base of the "good clay." Hence at some point between the "old shaft" and the bore-hole there must be a sharp reversal of dip, almost amounting to a "curl over" of the beds. Workings in the Aldermoor plantation are held to confirm this view, which may be called the "Gully theory." The late Mr. Laurence Pike indicated something of the kind, but unfortunately I was unable to obtain particulars at the time. His view was that the chief masses of "good clay," or "Ball clay," occur as lenticular bodies in a great series of variegated clays, and he further stated that the beds are occasionally found with a sharp reversal of dip, amounting to something like a "curl over," at the southern end.

It must be admitted that the evidence in support of the Gully theory is not very satisfactory, and I do not lay too much stress upon it. At the same time it is not improbable that there is some stratigraphical peculiarity running through the northern base of Creechbarrow, not very far, perhaps, from the 400ft. contour. This seems to have been felt by those responsible for the original survey map of this country, since a fault with a repetition of the London Clay is indicated approximately upon this line.* We cannot here ascertain what it was that the surveyors of those days took for London Clay on the north side of Creechbarrow, though it may have been the brown clay of Mr. Bond's brickyard. In the old survey map Creechbarrow is represented as a Bagshot outlier resting on a mass of London Clay contained in a forked fault.

The West Side of Creechbarrow.—This presents a more regular slope than either the northern or the eastern sides, and, being

---

* The material for a complete solution of this problem, viz., the relations between the Creechbarrow Beds and the Pipeclay series, is not yet to hand.

well grassed over, indications as to the composition of the beds are not easily obtained. There is an old pit about mid-way between the 500ft. and the 400ft. contour, but for what purpose it was made I have not hitherto been able to ascertain. Clay and flints are now to be seen at the bottom. Lower down on the north-west angle, commencing a little below the 400ft. contour, a small stream has cut a slight gorge, which displays a section of some interest. At about 380ft. above O. D. we found here :

Laminated yellow clay with flints,
Yellow sand.

This yellow sand may be traced some distance downwards, and presently we arrive at a considerable thickness of

Loose grit, the so-called "granite-gravel."

The specimens collected are somewhat larger than beans, and consist of chalcedonic quartz in small pebbles and angular pieces, a few flint pebbles and chips much degelatinized, a few grey quartzites and banded hornstone, and a considerable quantity of black "lydite," angular with rounded edges. The above must be accepted as a slight intimation of the composition of the Creechbarrow beds as developed on the west side of the hill. It is evident that along with much fine sediment there is a certain amount of coarse material: big flints are not rare, and I once picked up a boulder of pinkish quartzite in the bed of the north-west gorge above mentioned which greatly resembles the material of the Budleigh Salterton pebble bed.

Local Drift.—It is interesting to note that the belt of clayey drift which covers so much of the surface of the Old Bond Street workings is, in addition to the inevitable flints, largely charged with this "granite-gravel," so that in this case the Creechbarrow Beds have contributed to the material which now covers the Pipeclay area immediately beneath them.

A

B

Fig. 6.—Drift Loaded with "Granite-Gravel" above the "Two-Ball" Clay beneath John's Plantation (from a Photograph by Mrs. Hudleston).

A. The "two-ball" clay worked on the surface.
B. The local drift.

The South Side of Creechbarrow.—Here it is possible to arrive at more definite conclusions as to the character of the beds and also as to their relations to the neighbouring formations. The accompanying section, for instance, will serve to show the relation of the mass formed by the Creechbarrow Beds to the Lower Tertiaries (London Clay and Reading Beds) and the Chalk. One important point to bear in mind is that the neck of land, consisting of Lower Tertiaries, which connects Creechbarrow with the Chalk, has an elevation of 500ft., whereas the

Lower Tertiaries along the dip slope of the Purbeck Hill elsewhere rarely attain an elevation of 300ft. (see Fig. 1 for confirmation of this). Hence the agency which protected the Creechbarrow Beds protected the Lower Tertiaries to a certain extent. I cannot doubt that this agency was the hard concretionary limestone which now constitutes the summit of Creechbarrow itself, and which in all probability extended considerably further in a direction opposite to the dip after the manner of escarpments generally.

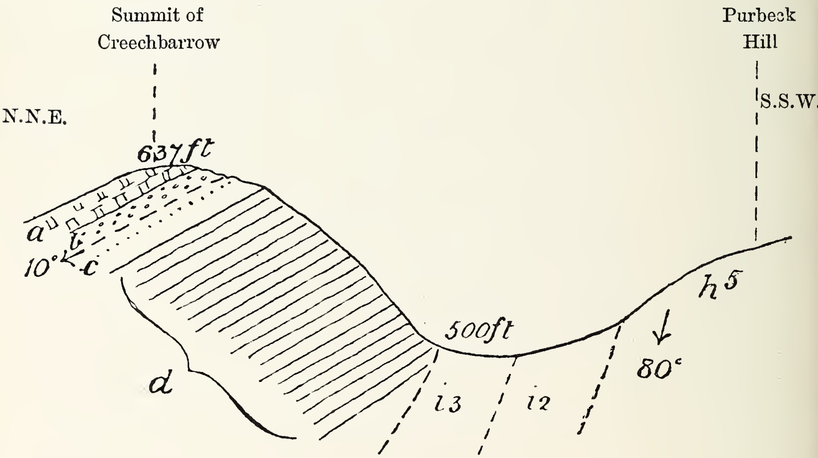


Fig. 7.—Generalised Section of Creechbarrow (South Side).

a-d. Creechbarrow Beds. *a.* The hill-top limestone. *b.* Sands with calcareous concretions. ← Bed of flints. *c.* Sands below the flint-bed. *d.* Beds not specially determined, mostly sandy. i3. London Clay. i2. Reading Beds. h5. Chalk.

Whether the Creechbarrow Beds are really uncomformable to the Lower Tertiaries, as shown in the diagram, I am unable to say. Also the angle of dip of these beds is only obtained by inference. The high dip of the Lower Tertiaries shown in the diagram is based on the three following considerations :—(1) on the narrowness of the outcrop, (2) on a dip of 80° towards the

north which is seen in the adjacent chalk-pit, and (3) on the fact that one of the ironstone-grits of the Reading Beds is seen in a vertical position about ¾ mile to the eastward of the section. With reference to the Creechbarrow Beds themselves, a dip of from 10° to 12° is obtained from observation for the topmost series,[1] but the actual dip of the lower beds, in immediate contact with the London Clay, as also their true stratigraphical relations, can only be a matter of inference.

The primary object of this investigation has been an endeavour to explain the causes which have led to the formation of such an exceptional feature in the landscape of the Isle of Purbeck as Creechbarrow, certainly the most noteworthy hill, composed exclusively of Tertiary beds, in all England. I have already stated that it was originally represented by the Geological Survey as being held up in a forked fault with a sort of repetition of the London Clay at its northern base. There certainly seems no justification for the introduction of the London Clay into this position, viz., the northern base of the hill. There may, however, be some better reason for the introduction of a fault, for it is just hereabouts that the junction of the Creechbarrow Beds with the Pipeclay series takes place. This is a piece of stratigraphy which I have not yet succeeded in solving to my own satisfaction, though such a question has only an indirect bearing on the origin of Creechbarrow as a hill. I am far from saying that everything in connection with its origin has been explained, but without doubt one great predisposing cause is the protection which the softer strata have received from the concretionary limestone. Such protection is not only accountable, in a great measure, for the existence of the hill itself, but also for its present shape, which has to a considerable extent been determined by the original form of the calcareous body that accumulated in some old Tertiary lakelet, ages before the uplift of the Purbeck Hills.

---

[1] See page 154.

PART II.

LITHOLOGY AND PALÆONTOLOGY.

The big Flints.—Before entering upon a detailed description of the Creechbarrow Limestone, there are some other matters of interest which may be considered. The first of these refers to the very large flints which have contributed in no small degree to the maintenance of the fabric of Creechbarrow, and which are such an exceptional feature in the Bagshot beds of this immediate district: their stratigraphical relations may be gathered from the preceding pages. As regards the general character and appearance of these flints, they are for the most part of a dirty cream-colour: they are also much degelatinized, and in some cases the exterior is simply a mass of granular silica, very meagre to the touch. They are also extremely brittle when first dug out, though it is probable that exposure to the atmosphere toughens them after awhile. In consequence of this brittleness the available fragments do not much exceed 28lb. in weight, so far as I have seen them, though it may well be that heavier flints than these occur. These flints have split in the bed itself. The surface of those flints which are not much broken has been subject to very little modification from abrasion. Associated with the big flints are flint pebbles and other stones of moderate size, also quartzose grit.

The peculiar fawn colour of these siliceous masses will help to distinguish them from ordinary plateau-gravel or valley-gravel flints; and the amount of soft and almost pulverulent material which coats so many of them is a further distinction, as this substance could never endure the wear and tear of the gravel-making processes. Without illustration, which would necessitate the employment of colour, it is by no means easy to convey an adequate idea of the peculiarities of the big flints, when freshly dug out of the beds which contain them. Their general appearance leads one to suppose that they had been subject to some corrosive action, and this is especially noticeable where

EXPLANATION OF THE PLATE.

FIG. 1.– Gasteropod encysted in concretionary layers. ? One of the Melaniadæ. Magnified $1\frac{1}{2}$ times.

,, 2.–Section, approximately horizontal, of the "horse-shoe" concretion. Nat. size.

,, 3.–Section of the "horse-shoe" concretion drawn so as to show a portion of the outer wall. Nat. size.

,, 4.–Egg-like body inside the "horse-shoe" concretion. Magnified 3 times.

,, 5.–Gasteropod. ? One of the Melaniadæ. Front aspect. Magnified $1\frac{1}{2}$ times.

,, 6.—Vertical section of Gasteropod, probably the same species as shown in Figs. 1 and 5. Magnified $1\frac{1}{2}$ times.

,, 7.–Cf. *Melanopsis brevis*, Sowerby. Front aspect. Magnified $1\frac{1}{2}$ times.

,, 8.—Section of a similar specimen. Magnified $1\frac{1}{2}$ times.

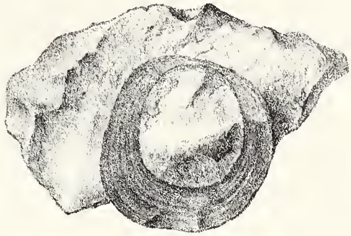
,, 9.—*Paludina* cf. *lenta*, Solander. Front aspect. Magnified $1\frac{1}{2}$ times.

N.B.—Figs. 6 and 8 show the encrusting action to which most of these shells have been subjected, and which tends to obscure their true character.

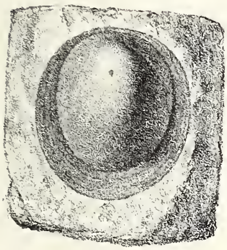
1

×1½

2

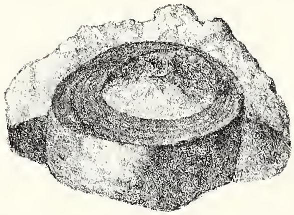


4



×3

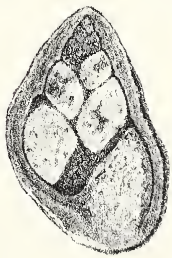
3



5

×1½

6



×1½

9

7

×1½

8

×1½

G. West lith.

SHELLS & CONCRETIONS FROM
THE CREECHBARROW LIMESTONE.

there are any indications which may have been due to organic bodies, such as urchins or sponges.

When these Creechbarrow flints have been rolled down the hillside, and subjected to atmospheric action, the external coating of loose silica is found to have been entirely removed, and the flint itself bleached to a dirty white condition, though the casts of Pectens and other fossils still retain traces of iron-discolouration.

The Manganese nodules.—There are considerable traces of black oxide of manganese both in the clays and limestones of Creechbarrow, but the remarkable nodules which I am about to describe have only been found in the yellow sand underlying the great flint bed on the eastern spur (see p. 169). Here the most beautiful botryoidal masses of this black oxide, which is probably the hydrated peroxide, or psilomelane, are common and of great variety in form. The one figured has a length of five inches, and its specific gravity considerably exceeds that of the manganese nodules which are figured in the description of the

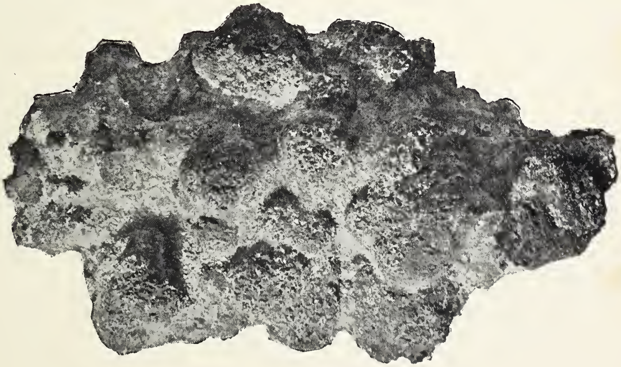


FIG. 8.—ONE OF THE MANGANESE NODULES FROM THE EASTERN SPUR OF CREECHBARROW.

Reduced $\frac{2}{3}$ (from a photograph).

voyage of the "Challenger."* In other respects there is a general resemblance, the chief difference being that in our case ordinary quartzose sand functions as the material caught up by the mineral instead of fine pumice and volcanic fragments, &c., as in the case of those found at the bottom of the Pacific. I have not seen any nodules from the Pacific where the mamillæ are so salient or so rough as those from the east spur of Creechbarrow, which are handsomer in shape, heavier, and present greater contrast of colours. It is evident that great depth is not absolutely necessary to the formation of manganese nodules, as the Creechbarrow Beds being associated with fresh water limestone could not be other than shallow water deposits, whilst the manganese nodules from the bottom of the Pacific Ocean were formed in depths between 2,500 and 3,000 fathoms.

The Creechbarrow Limestone.—Perhaps the first stage in the description of this curious rock should be an illustration of the mode of its growth in the associated sands. This may be well studied in No. 4 pit, where there were several calcareous nodules just underneath the irregular base of the great mass of limestone. The one figured below may be deemed characteristic.

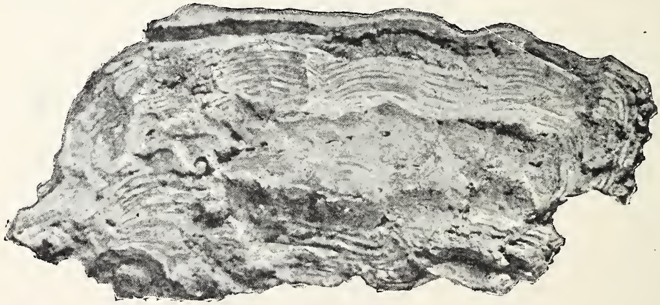


FIG. 9.—PART OF A CALCAREOUS NODULE FROM NO. 4 PIT.

Natural size.

---

* Deep Sea Deposits. Plate II.

Externally there is a kind of skin made up of very closely set calcitic layers which have a rough exterior and include a few sand grains. The rest of the nodule consists mainly of carbonate of lime with a small amount of very fine mechanical sediment. In this respect it differs greatly from the manganese nodules, which take up a large quantity of the sandy matrix. The concentric character of this concretionary body is well shown towards the exterior and occasionally in the interior, but the general mass is a rather light porous material with denser nests of calcitic matter here and there. Some of the holes in the more porous parts are suggestive of slender stems round which deposition in the first instance has taken place, and the aspect generally may be described as tufaceous.

Varieties of the Creechbarrow Limestone.—There are considerable extremes in this respect, ranging from a soft marly deposit, which soils the fingers like whitening, to a hard compact rock, which takes a good polish. Unquestionably the most dense and compact limestone is that near the summit, whilst the soft marly beds are on the northern slope, and especially near the 500ft. contour, where some of them are earthy and contain a considerable amount of impurity, so that they may at least be called marly limestones. On the other hand there are compact white limestones, where nests of dog-tooth spar form no inconsiderable portion of the mass. Quartz grains may be noted on most of the weathered surfaces.

The more compact and denser limestones, which prevail near the summit, may be roughly divided into non-pisolitic and pisolitic rocks. Thus, for instance, I have before me (Group 1) specimens of a very heavy and partially calcitic rock. It is a hard whitish limestone without pisolites, but largely interspersed with buff-coloured patches, not unlike some dolomites. Calcitic nests and strings occur, and also strings and stars of black oxide of manganese: the external surface is rough and somewhat honeycombed, and full of curious impressions, some of which may have an organic origin.

Group 2 comprises those specimens where the pisolitic character is indicated, but not very obviously. A characteristic specimen may be described as follows: A large fragment of a creamy white tufaceous limestone, with specks and threads of black oxide of manganese in places: flattened pisolitic bodies in brownish calcite are numerous, but not very distinct. There are casts of interiors of a univalve shell, which is most probably *Paludina*. The whole of this fragment has a tufaceous aspect, and is free from buff-coloured patches. The external surface is rough and in one corner is full of curious shapes, which are doubtless concretionary bodies developed by weathering. On further examination of these curious shapes, I note indications of the concentric structure, which convinces me that they are pisolites developed by weathering.

*The Pisolites.** (*Group* 3.)—Originally I divided these limestones into four groups, but the pisolitic limestones may be taken as one group. The following is the description of a specimen of this class of rock.

A creamy tufaceous limestone with some buff-coloured patches and specks and threads of manganese oxide. Sections of ordinary pisolites here and there. But this specimen is remarkable for three very large *horseshoe sections*, which certainly represent concretions in brown calcite. The first specimens I obtained were incomplete in outline, thus causing an appearance of being open at one end, like a horseshoe. Specimens subsequently obtained showed that this was not exactly the case. Where the periphery of the section is complete, as in the specimen figured on the plate (Figs. 2 and 3) it is seen that the section of this large concretionary body is thick at one end and thin at the other. Figure 3 of the plate especially shows a side view of this curious body, where, taken by itself alone, it might almost be regarded as a fragment of a big belemnite. The

---

* The accompanying Plate is intended to illustrate concretionary or pisolitic action as well as to serve the palæontology of the limestone.

section shows a series of concentric rings of brown calcite with a large hollow in the centre filled with the ordinary matrix. There is no radial structure; one end of the circle, as previously noted, is thick, whilst the opposite end thins out to such an extent that in some specimens it is not to be traced. Some of these "horseshoe" sections are nearly 1½ inches in diameter.

The Egg-like Body. (Fig. 4 of the plate.)—For a long time these so-called horseshoe concretions were a puzzle to me, and, as they were for the most part only obtained in fragments, there seemed to be no possibility of solving the enigma. At last by good luck we stumbled on a still more curious body, which is perhaps the most perfect pisolite ever discovered. In this case we perceive a pisolitic concretion with an interior like a very small egg, of which the shell, represented by the concentric layers of brown calcite, is developed so obliquely that it is quite thick on one side and thin on the other side. This specimen has been broken so fortunately that we recognise our horseshoe section at once, with the matrix in the form of an egg projecting from the unequally-developed circle.

Those who regard pisolites as organic will doubtless welcome this egg-like form as a new species. But, as a further illustration of the eccentricities of concretionary action, I would direct attention to Fig. 1 of the plate, where the shell of a univalve, most probably a *Paludina*, has been encysted in a number of concentric layers of brown calcite. A similar concretionary action has taken place round other specimens of univalve shells, of which sections are given in Figs. 6 and 8 of the plate. This action is interesting from a lithological point of view, but, as we shall perceive subsequently, it renders the palœontology more difficult of interpretation. However, the above instances serve to show that concretionary action has been rampant in the Creechbarrow Limestone, and it is to this action that we must ascribe most of the peculiarities of the rock.

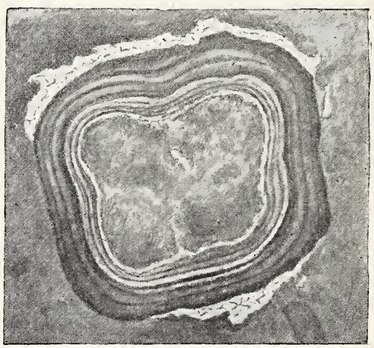


FIG. 10.—FRAGMENT OF THE HARD PISOLITIC LIMESTONE SHOWING TWO FACES CUT AT RIGHT ANGLES TO EACH OTHER AND POLISHED.

Magnified $1\frac{1}{2}$ times.

FIG. 10a.—SECTION OF ONE OF THE PISOLITES, DRAWN AS A TRANSPARENCY.

Magnified 6 times.

In those cases where the pisolitic concretions are numerous and the limestone is very compact, as shown in Fig. 10, the rock cuts well and takes a fairly good polish. In this instance the ground mass is of a dull cream colour, mottled with buff patches, and the sections of the pisolites appear in dark brown calcite, which contrasts well with the non-crystallized matrix. There is much more variety in the shapes of the pisolites than can be gathered from the small fragment figured, but they may be classed as quadrate, circular, and oblong, some showing considerable irregularity of outline. Whatever may be the shape of these smaller concretionary bodies, they conform to the conditions already detailed with regard to the larger ones previously described as the horseshoe form. The structure is entirely concentric, and this is shown in the flattened pisolites as well as in the circular ones. Some of these bodies are seen to be compound, with a very irregular periphery, having two or more foci of crystallisation, and in this way very curious figures result.

The magnified section of one of the quadrate pisolites (Fig. 10*a*) displays some features which are not seen in all the specimens. For instance, there are two lacunæ of clear calcite, which partly separate the regular annular system of brown calcite from the ordinary matrix. This is probably due to partial solution of the matrix subsequent to the formation of the pisolitic concretion. We notice belts of clear calcite also in the annular system, especially towards the interior, giving the rings an agate-like appearance. The core, or centre of the pisolite, consists of the matrix partially modified, but without the brown specks which characterise it. This appears to be the case in all sections of the pisolites which I have examined, and suggests that the slight amount of colouring matter, due to iron oxide, which characterises the rings of brown calcite, has been transferred from the included portion of the matrix to the annular system surrounding it by a sort of centrifugal flow-action such as that which forms the ironstone shells of limonitic deposits. In the case of some of the pisolites the centre consists of clear

crystalline calcite, making the analogy with the ordinary siliceous agate still more complete.

There remains only one further remark to make in dealing with these curious pisolites, and that refers to a suggestion that these concretionary bodies may possibly in the first instance have been due to Nummulites. Everything tends to refute this supposition, more especially the association of these pisolitic limestones with *Paludina* and *Melanopsis*. Yet it must be admitted that there is a considerable resemblance to limestones showing sections of Nummulites, although the resemblance is apparent rather than real, as may be seen on closer investigation, and it can be safely affirmed that nothing approaching organic structure has hitherto been detected in these pisolites. It is certainly a curious coincidence that both *Nummulites lævigatus* and *N. elegans* occur in the Lower Eocenes of this country, mainly perhaps in the Brackleshams, but also in the Barton Beds ; so that, if the Creechbarrow Limestone had been of marine origin, there would have been nothing surprising in the occurrence of Nummulites in any beds of Bagshot or of approximate age.*

Palæontology.—Very little can be said under this head, as the only specimens of fossils from the Limestone have been derived from the limited area of the summit pit or the immediate neighbourhood. There can be no doubt that *Paludina* is fairly common, as it occurs both in the form of shells and casts by no means infrequently. The shells are often obscured by a concretionary investment, as previously stated, but there is sufficient material to form a fair idea of the species. It is a form which clearly differs from the ordinary Purbeck species (*P. carinifera*

---

* According to Prof. Rupert Jones, writing of the physical features of the Bagshot dictrict in 1880 (Proc. Geol. Assoc., Vol. VI., p. 437), "The Bagshot sands are the shallow water and western equivalents of the great Nummulitic formation, which is represented in the east by the thick Nummulite limestones, deposited in the open ocean of the period."

and *P. elongata*), but which has a fairly good resemblance to the Bembridge species, *Paludina lenta*, Solander.*

No object would be gained by attempting a technical description of fossils so obscured by incrustation as are these Creechbarrow Gasteropoda, but I must direct the attention of the reader to the accompanying plate. According to my ideas, Figs. 1 and 5 represent the back and front view respectively of a form which may possibly be a member of the Melaniadæ. The shell shown in Fig. 1 is enclosed in a series of cysts; the one shown in Fig. 5 appears to me to represent the same species. It is true that the aperture, in its present condition, gives us very little insight into the true character of the shell, but this is due to disfiguration from several causes. Fig. 6 may represent a section of the same species, and here again the elongate character of the whorls points to some member of the Melaniadæ rather than to *Paludina*.

In the case of Fig. 9 the aperture has been better preserved, and few would doubt that this specimen represents a *Paludina*. It most resembles *P. concinna*, Sowerby, which Mr. Bullen Newton (British Oligocene and Eocene Mollusca) regards as the same as *P. lenta*. Although there are plenty of casts in the limestone which one would refer without hesitation to *Paludina*, this is the only specimen of a shell which shows the *Paludina* mouth with certainty.

Figs. 7 and 8 of the plate represent specimens (the latter in section) which have suffered terribly from incrustation, to the complete obliteration of the true external form; yet I think that in them we may recognise *Melanopsis brevis*, Sowerby, described from the Bembridge series. I have no doubt that a more

---

*In my paper in the Geological Magazine (Dec. 4th, Vol. IX., p. 251), I referred this form to *P. media*, Woodward, a synonym of *P. lenta*, Solander, the latter being the correct name. The history of *P. lenta* is rather a singular one. It was first described by Solander (1766) in Brander's Foss. Hants., and is regarded as ranging from the Woolwich (and Reading) Beds to the Hempstead, Bembridge, and Headon Beds. Hence it is essentially an Eocene and Oligocene species.

extended search would yield a larger series of fossils, since the few specimens of Gasteropoda, which have been figured, were derived from a very limited area, viz., the summit pit.

As regards any other fossils from the Creechbarrow Beds, there is a fragment something like *Ditrupa* in one of the more earthy limestones. A bivalve, not unlike a *Lucina*, was also obtained from a fragment of an ironstone grit found on the surface between the summit and the eastern spur, but, as I have never seen this particular bed *in situ*, too much importance should not be attached to this "find."

Conclusion.—The question of the actual age of the Creechbarrow Limestone is one which I have naturally deferred to the last, in order that we might be in possession of all the available evidence. Its approximate age is clear enough as being Lower Tertiary, but the question now more particularly to be solved is this: Are we to believe that the Creechbarrow Limestone is really of Lower Bagshot Age and rather low down in the Bagshot series, as appearances might seem to indicate, or are we to believe that it is of Oligocene Age and a local representative of the Bembridge Limestone? It has already been admitted that hitherto I have failed to settle this question from a study of the stratigraphy of the hill, although the bulging of the Pipeclay series is certainly in favour of the view that the Creechbarrow Beds do not overlie the Pipeclay series, as must be the case if they or any portion of them represent the Bembridge Limestone.

Do we obtain a better clue either from the lithology or the palæontology of the limestone? I fear not. The two species of Gasteropoda, which may be regarded as fairly well identified, viz., *Paludina lenta* and *Melanopsis brevis*, are certainly Bembridge species, but the former occurs in the Woolwich Beds, and we may well believe that the latter also had a long life as a Lower Tertiary freshwater species, so that its presence must not be taken as indicative of any special horizon. The lithology is equally uncertain.

So far as I am acquainted with museum specimens of the Bembridge Limestone, it has a somewhat different aspect to that

from near the summit of Creechbarrow, and is, on the whole, non-pisolitic. Yet there are in the Bembridge Limestone some very enigmatical bodies. Amongst these are the supposed "Cocoons" referred to by the late Mr. F. E. Edwards as possibly being the eggs of freshwater tortoises, or even snails. These bodies are said to possess no internal structure. Not having any of these "Cocoons" by me at the present moment, I am unable to give any further description of them, although I strongly suspect that they are not organic any more than our "horseshoe" pisolites, but most probably the result of concretionary action. Hence there would seem to be established a certain degree of analogy, *quâ* lithology, between the Bembridge and Creechbarrow Limestones, although this can scarcely be allowed to outweigh the stratigraphical inferences to be drawn from the bulging of the Pipeclay series.

Thus, on summing up all the evidence hitherto available, I rather incline to the view that the Creechbarrow Limestone and associated beds are of Lower Bagshot Age, yet at the same time I am bound to admit that it is a point which can only be decided with certainty by further investigation.

Postscript.—Since the article on Creechbarrow was completed there are two points on which a certain amount of additional information has been received.

1. A deep boring south of Mr. Bond's brickyard is thought by Mr. Leonard Pike to indicate the presence of Pipeclay at a considerable depth within the area hitherto regarded as sterile (see note 2 in the "Explanation of the Sketch-map of Creechbarrow" on page 163). If the clays in this boring represent the great mass of Pipeclay such as has been excavated from the "Old Clay Pits," then the theory that Creechbarrow bulges the Pipeclay series can scarcely be maintained any longer. But if, on the other hand, the material lately discovered is merely a local manifestation of pipeclay such as might occur to a small extent on almost any Bagshot horizon, the recent discovery cannot be regarded as contravening the general impression which has hitherto prevailed.

2. On referring to Edwards' monograph of the Eocene Mollusca (Pal. Soc., 1852), I perceive that he describes with considerable detail the bodies regarded as the casts of eggs, which were found in the Bembridge Limestone. Those most commonly found, he says, present a close resemblance both in size and shape to the eggs of several of the freshwater tortoises, and may be casts of the eggs of species of *Trionyx* or *Emys*, which lived in the Eocene marshes. Others he thought might be casts of some Helicidæ.

Although we cannot show anything from the Creechbarrow Limestone which exactly corresponds to the supposed eggs from the Bembridge Limestone, yet a successful reconstruction of the larger "horseshoe" pisolites from Creechbarrow might possibly produce forms not unlike the "eggs" which attracted the attention of Mr. Edwards. If this should prove to be the case, there may be more similarity between the two limestones than has hitherto been supposed.

A Short Account of the Cruciform Sun Dial at the Dorset County Hospital.

By JOHN E. ACLAND.

IN June, 1846, Mr. Arthur Acland, of Wollaston House, Dorchester, presented to the Dorset County Hospital a sun dial made in the shape of a cross. It was cut in stone by Mr. Acland himself, and was placed at (what was then) the S.W. corner of the building, the present south, or "Bankes," wing not having been built at that time. But, when the new wing was added, it became necessary to move the sun dial, and for many years it stood at the edge of a flower-bed in a bad position, partially shaded by trees. Moreover, when it was moved, it was, through ignorance or carelessness, turned completely round, so that the proper south end pointed to the north, rendering it absolutely useless. In course of time also the cross was cracked; part of the head was broken off and disappeared, and the hour figures were nearly obliterated. And so it remained in this sad plight up to the summer of 1901, when I was permitted to restore it, and have it moved to a fairly good position on the plot of grass in front of the hospital. As this form of sun dial is somewhat uncommon,

a short description of the way in which it should be fixed, and of the manner in which it shows the time will not be out of place.

The dimensions of the cross at the County Hospital are as follow :—

Length of each arm, $4\frac{1}{2}$ inches.
,, the head, $4\frac{1}{2}$,,
,, main shaft, 6 ,,
Width of each member of the cross, 3 inches.
Depth of each member, $5\frac{1}{2}$ inches.

The depth is perhaps the most important dimension.

In fixing the dial, the first necessity is to see that the head of the cross points exactly due south, *i.e.*, lies in the plane of the Meridian, so that at *12* o'clock noon by Solar time (not Greenwich time) the head of the cross casts no shadow whatever on either arm. It is also of primary importance that the edges which cast the shadow (or the gnomons) are at the correct angle with the horizon, for it is the fundamental principle of all dials that the gnomon should be parallel to the earth's axis.

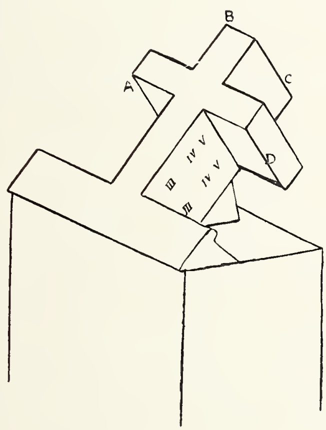
Now, as the edges which cast the shadow are at right angles to the surface of the cross, the surface of the cross becomes parallel to the plane of the equator, and thus forms a very interesting feature, and indeed distinguishes the cruciform dials from others, for during the winter months, from the end of September to March, the sun will move wholly below the plane of the surface of the cross, which will be therefore always in shadow; but in the summer months, from April to September, the sun will shine wholly above the cross, and it is the pretty practical illustration of the motion of the sun in the ecliptic, higher or lower according to the season of the year, which makes this sun dial so interesting to watch from day to day and from month to month.

At the equinox, in March and September, the width of the shadow exactly coincides with the width of the cross, but at no other time of the year. Throughout the summer, the sun being high, the shadow is thrown *down*, so that at midsummer only the

upper half of the shadow falls on the cross; whereas throughout the winter, the sun being low, the shadow is thrown *up*, and at midwinter only the lower half of the shadow is seen.

This variation necessitates the unusual depth of the cross.

In the common form of simple horizontal dials there is one gnomon, which casts its shadow on the plate on which it stands, generally a circular plate with the hours engraved upon it. In the cruciform dials there are really four gnomons, and the shadows from them fall at different times of the day on four different parts of the cross itself, each gnomon in turn doing its allotted task for a period of three hours. The side edges of the head of the cross provide two of the gnomons, and the extremities of the two arms provide the other two. Three of these gnomons can be seen in the accompanying sketch marked A, C, D.



At 6.0 a.m. the sun will shine exactly on the end of the eastern arm, but in a few minutes the shadow cast by edge A will be seen on the eastern side of the main shaft, which it will gradually descend, marking the hours 7, 8, and 9 a.m.

At 9.0 a.m. the head of the cross commences to record the hours on the south side of the western arm, the shadow from edge C creeping along towards the centre until 12.0 noon, when

the sun shines direct on the end of the cross, and there is again no shadow at all visible. From noon till 3.0 p.m. the eastern edge of the head of the cross, marked B, takes up the work, the hours being recorded on the eastern arm, and from 3.0 p.m. to 6.0 p.m the western side of the main shaft becomes the "clock face," the shadow being cast on it by the edge of the western arm, marked D, until at 6.0 p.m. exactly this shadow also disappears.

I am informed that similar dials exist at Harrow on the school terrace; at Shenstone, Staffordshire; and in the churchyard of Collaton S. Mary, Devon, where may be seen engraved on the pedestal the following lines:—

> If on this dial fall a shade,
> The time redeem,
> For lo! it passeth like a dream.
> But, if it all be blank,
> Then mourn the loss
> Of hours unblessed by shadows from the cross.

The Ancient Memorial Brasses of Dorset.

By W. de C. PRIDEAUX.

Part I.

PIDDLETOWN AND BERE REGIS.

"This may be one and no contemptible argument in favour of such kind of accounts that, when monuments themselves decay, inscriptions wear out or are defaced, marble broken, brass plates unfixed or thrown aside out of sight, or perhaps returned to the founder, or sold to a tinker; when effigies, arms, and inscriptions in glass, etc., are broken, mangled, and disappear, the contents of them may be preserved in a sheet of paper—*monumentum ære perennius.*"

Delafield MSS.

(I.) PIDDDLETOWN ST. MARY'S,

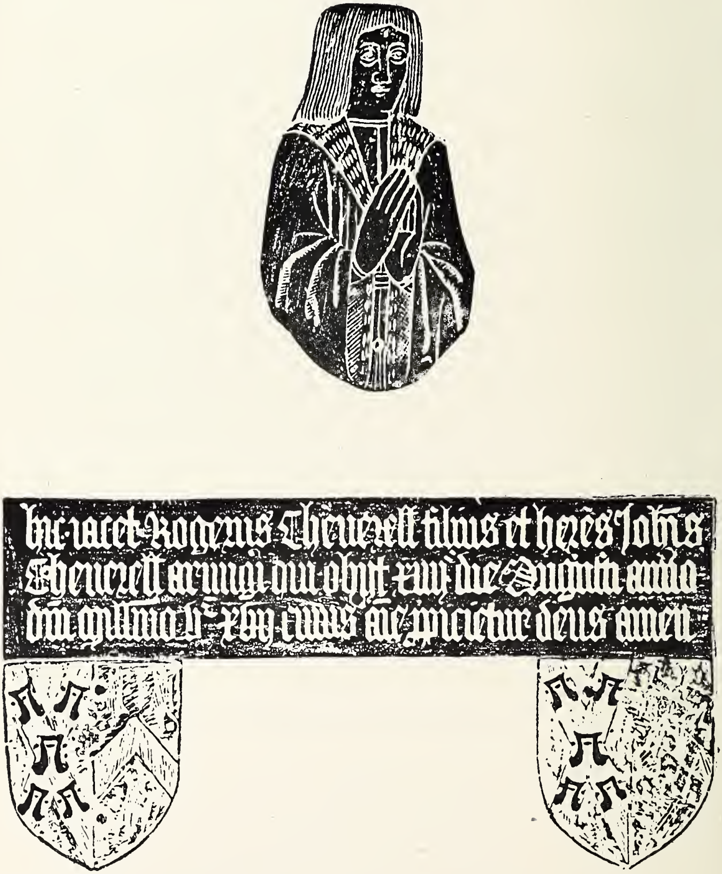
ROGER CHEVERELL.

"ROGER, son and heir of John Cheverell, Esq., 1517, lower half of effigy lost, relaid, choir."—*Haines.*

Position.—Relaid on slab in nave near step leading into chancel.

Size.—Effigy, 10½in. by 6in.; inscription, 19¼in. by 4¼in.; heraldic shields, 4¾in. by 5¾in.

Description.—Demi-effigy, as of civilian, of early part of 16th century, head bare, no hood shown on either shoulder, gown thrown open in front, exposing fur lining both above and below girdle, sleeves loose; similar in



1. ROGER CHEVERELL.

character to Thomas Goddard, Ogbourne St. George, 1517, and John Barley, Preshute, 1518, Wiltshire; below, a rectangular plate with inscription in old English lettering abbreviated, of which the following is an extension:—

"hic iacet Rogerus Cheverell filius et heres Johannis Cheverell, armigeri, qui obiit xiiii die Augusti, anno domini millesimo v^c xvii cujus animæ propicietur deus. Amen."

Inscription would appear of a style rather earlier than date on brass. See Westminster Abbey, 14th and 15th cent.

Heraldry.—Below dexter corner of inscription on a shield:—Arg. on a saltaire Az. five water bougets or, Cheverell; Impaling a chev. between three lions' paws erased (Hutchins). Query, a chev. between three hawks' or eagles' heads erased, Raves. [this charge impaled with Cheverell coat in glass at Chantmarle]. Below sinister corner, on a shield Cheverell impaling on a chevron gules between . . . . three pellets, much worn. Hutchins speaks of a scroll issuing from mouth of effigy; no trace remains.

Biographical Notes.—Roger Cheverell, *alias* Sacheverell, of Chantmarle and East Stoke, son and heir of John Cheverell and Margaret, his wife, dau. of John Wykes, of Bindon, co. Dorset, married Anne, dau. and h. of Thomas Raves, of Ditchfield Media, co. Worcester, by Elizabeth, dau. of David Brayles, co. Salop, Esq.

"Thence the river passeth by Chantmarle which gave Sirname to a familie and of them John bettered his estate by a heire of Sir William de Stoke (vaire O. & G. a chief S,) but his grandchild left one onlie daughter his heire Joan, wife of John Cheverell or Sacheverell, whose posteritie remain'd here in good esteeme even untill our Time."—*Coker*, p. 59.

By an indenture made 3 Hen. VIII. between Roger Cheverell of Chantmarle, Esq., and William and Edmund Cressall of "Blanford" Forum, the sd. Roger "demyseth and to farm letteth all his messuages, lands, rentes, pastures, and meadows

called Stoke Hyde," in the Parish of Blanford Forum, unto the aforesaid Wm. and Edmund, for 20 years; a rose to be rendered yearly for the first eight years, and £5 yearly for the remainder of term: Witnesses Mast. John Attwell, Mast. Robert Harys, William Atwell. MS. penes T. H. Bastard, Esq.

9 Henry VIII. Roger Cheverell at his death held a messuage and 70 acres of land of John Morton (descendant of the Cardinal) as of his manor of Swyre (Esch.), and he also held 9 Hen. VIII. the manor of Nether Stirthill in Burton Bradstock.

Roger Cheverell was an ancestor of the famous Dr. Sacheverell.

(2.) PIDDLETOWN ST. MARY'S,

CHRISTOPHER MARTYN, ESQ.

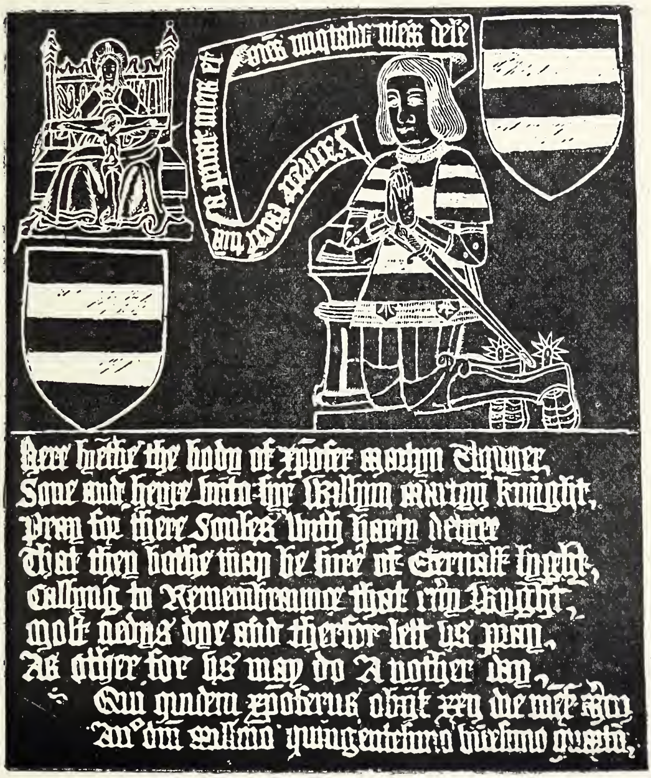
"Christopher Martyn Esq. son and heir of Sir Wm. Martin, 1524, in tabard, 7 lines engraved verse, quadrangular plate, mural South Chantry."—*Haines.*

Position.—In recessed slab on east wall of south or Athelhampton aisle.

Size.—18in. wide by 21in. high, of which the upper 12in. contains effigy.

Description.—It is one of the examples given by Haines of Brasses (circa 16th cent.) having a background plan, rather than simple outline of the effigy, the earliest given being to Sir Thos. Sellynger and lady 1475.

Christopher Martyn is given in complete armour, but conventionally treated, and is wearing a tabard carrying his arms. In the dexter corner is a representation of the Trinity. The Almighty Father, the "Ancient of Days," is represented as a monarch seated, but uncrowned (compare Fairford, Gloc.). He wears a long flowing robe, His hair and beard are long, the first two fingers of His right hand are held up in benediction, whilst His left hand holds a cross, tau-shaped, to which is nailed God the Son, both figures are nimbed. There is no dove apparent; omitted here, as at Hildersham, Camb. circa, 1380.



2. CHRISTOPHER MARTYN.

Heraldry.—Low in front and behind head are repeated the Martyn arms on escutcheons, Argent two bars gules.

The knight kneels bareheaded, and from his uplifted hands runs a scroll bearing the following :—

"Averte faciem tuam a peccatis meis et omnes iniquitates meas dele."

Below is the inscription :—

Here lyethe the body of Xpofer Martyn, Esquyer,
Sone and heyre unto Syr Willyam Martyn, knyght.
Pray for there Soules with harty desyre,
That they bothe may be sure of Eternall lyght,
Callyng to Remembrance that every Wyght,
Most nedys dye, and therefor lett us pray,
As other for us may do Another day.
Qui quidem Xpoferus obiit xxii die mense Marcii,
Anno domini millesimo quingentesimo vicesimo quarto.

Biographical Notes.—Christopher Martyn of Athelhamston, son of Sir William Martyn, K.B., and Isabel his wife, dau. of Thomas Farringdon of Tincleton (Coker, p. 74), married Christine, dau. of John Cheverell of Chantmarle. At his death 17 Hen. VIII. held Athelhamston of the Prior of Christchurch Twynham and the Manor of Tincleton. By Edith, his second wife, he had issue Thomas, who, dying before his father, left issue, by Mary his wife, dau. of James Daubeney, Robert, 17 years old, married to Elizabeth, dau. of John Kilway (Cole, Esch.). 3 Ed. VI. Robert Martyn, Esq., at his death held this Manor and Burleston; the Manors of Faringdon and Tincleton and Little Piddle *alias* Thorpe; the Manor and advowson of Woodsford, and a messuage in Bardolfeston and Piddleton, value 40s. Nicholas Martyn (post), his son and heir by Elizabeth, his wife, age 20, who had his livery the same year (Cole, Esch.).

(3.) PIDDLETOWN ST. MARY'S,

NICHOLAS MARTYN, Esq.

"Nicholas Martyn, Esq. 1595, in armour, with 3 sons & 7 daughters 4 of whom he left cohs. Elizabeth, Frances, Jane and Anne [he marr. Margaret dau. & h. of John Wadham of Meryfield] mural Altar Tomb South Chantry."—*Haines.*

Position.—Mural, behind altar tomb against south wall of Athelhampton aisle.

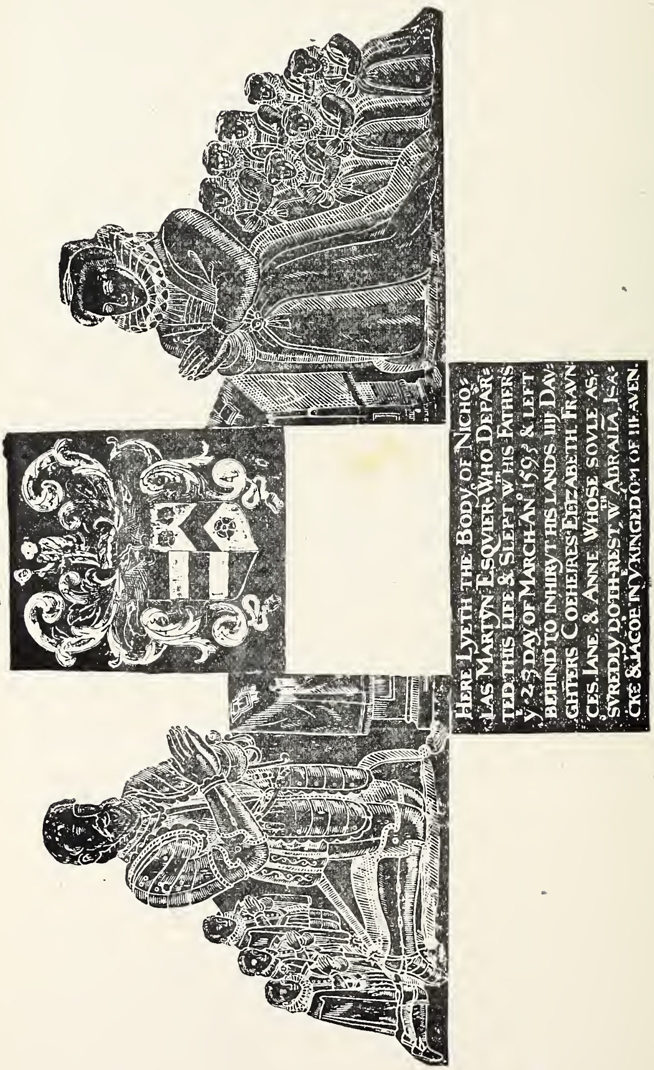
Size.—Nicholas and three sons, dexter, 17½in. wide by 18½in. high; Margaret and seven daus., sinister, 18½in. wide by 17½in. high; heraldic slab, 12½in. high by 11in. wide; inscription below, 9in. by 16½in.

Description.—Four brass plates under canopy; on the dexter side is shown Nicholas Martyn in the armour of the period with sword and spurs. He is bareheaded and wears a pointed beard and moustaches, and is kneeling before an altar, upon which is an open book; behind him kneel his three sons.

The armour of Elizabethan times allowed more "play" having more joints than earlier examples; especially is this seen in the Tassets or upper leg guards, made hinged to allow of the puffed and slashed trunk-hose then in vogue.

On the sinister side appears Margaret Martyn kneeling on a cushion before a similar altar, with hands upraised in prayer, and behind her, her seven daughters, also kneeling and similarly dressed; she wears the costume usually seen in the portraits of Queen Elizabeth and ladies of rank at the end of the 17th century. Very large ruffs, starched and supported on wires, a long-bodied stomacher, peaked at the waist as usual, close sleeves with plain cuffs, the skirts project abruptly from the hips, and were extended by large farthingales of whalebone.

Heraldry.—Above on rectangular brass: Arg. two bars gules, Martyn, impaling gules a chevron between three roses, Wadham, having the Martyn crest above; a Martyn proper, chained to a stump of a tree or, sejant, holding in his paw a mirror azure.



3. NICHOLAS MARTYN.

Below is inscription in Roman type :—

"HERE LYETH THE BODY OF NICHOLAS MARTYN ESQUIER WHO DEPARTED THIS LIFE & SLEPT WTH HIS FATHERS YE 23 DAY OF MARCH ANO 1595 & LEFT BEHIND TO INHIRYT HIS LANDS IIII DAVGHTERS COEHEIRES ELIZABETH FRAVNCES JANE & ANNE WHOSE SOVLE ASSVREDLY DOTH REST WTH ABRAHĀ ISACKE & JACOB IN YE KINGEDOM OF HEAVEN."

Athelhampton came to the Martins, "a right ancient familie, through marriage with the heir of Henry de Piddle, long since Lorde of it."—*Coker*, p. 79.

The first William Martin paid a fine for the release of his lands and castle of Pidela in Dorset, in 1207 (Rot. Fin., 9 John, memb. 13), and was dead in 1209. He had married Avicia, to whom he had assigned the Manor of Pulle as dower, and of this she had seizin in 1216, probably on the death of her son (Rot. Litt. Claus., 17 John, pt. I., memb. 4).* The second William held the honour of Cameis, in Wales, and had letters of protection while residing in that country in 1209. (Rot. Litt. Pat., 10 John, memb. 1).† The Arms of Dartington, co. Devon, are Argent, two bars gules. The Martins were Lords of Dartington.

Biographical Details.—Nicholas Martyn of Athelhampton married Margaret, second dau. of John Wadham, of Merifield, co. Somerset, and Edge, co. Devon, and Joan, his wife, d. and coh. of John Tregarthen, co. Cornwall ; her elder sister Joan married Sir Gyles Strangways of Melbury, and a younger sister, Florentina, married John Wyndham, whilst Nicholas Wadham, her brother, founded in 1613 Wadham College, Oxford, of whom Fuller says he kept such hospitality that "his house was like an inn at all times and like a Court at Christmas."

* Mandatuꝰ est Vic̃ Sumset̃ qđ hr̃e fac̃ Avicie q̃ fuit ux̃ Willi fil Martini plenar̃ saisinā de manꝰio de Pulle qđ ꝑdc̃us Wills in vita sua assignavit in dotē suā.

† Will's fil Mar̃t ht litt̃as de simplici ꝑtecĩ qadiu fũit ĩ Walla.

"This familie flourished there in great worshippe even untill our Father's Dayes."—*Coker.*

Nicholas, the last of the Martyns, dying without issue male in 1595, his estate came to his four surviving daus., between whom it was divided—Elizabeth, m. Henry Brune; Jane, m. Henry Tichborne; Frances, m. Thos. White, of Fittleford; and Anne, m. Anthony Floyer, of Floyer's Hays, near Exeter. Sir John Brune, as heir to his mother Elizabeth, dwelt at Athelhampton. In contemporary words: "Nicholas ye first, and Martyn ye last. Good night, Nicholas."

(4.) BERE REGIS ST. JOHN'S,

SKERNE.

"— Skerne and wife Margaret [Thornhull], who placed 1596, 8 line engraved verse, mural altar tomb."—*Haines.*

Position.—Mural, behind freestone altar tomb on north side of chancel, slab below shows traces of protective iron railings.

Size.—Effigies, each 14in. by 9in. wide; coat of arms, 14in. by 15in. high; inscription below, 20½in. by 7½in.

Description.—The brasses represent kneeling figures of Skerne and Margaret his wife, the former clothed in the Elizabethan long gown with no waistband, but having sleeves nearly touching the ground, the doublet sleeves being passed through slits above; the latter has the usual dress of the period with ruff around neck and apparently widow's wimple over her head.

Heraldry.—Above, on a brass escutcheon, appear these arms:—Quarterly 1st and 4th, gules, three castles, triple towered Arg. 2nd and 3rd, gules, a lion rampant Arg., a crescent for difference Skerne, Impaling Argent a chevron gules between three blackbirds sable, beaked or. *Thornhill* als. Thornhull. Papworth gives Skerne or Skearne, Bonby co. Lincoln—Gules in the dexter chief and sinister base a tower (triple-towered Castelyon co. Lincoln; and Castillon) and in the opposite points a lion rampant, or. Crests over Skerne, a castle triple towered; over Thornhull, in a bush proper a blackbird.


IF EACH THINGS END DOE EACH THINGS WORTH EXPRESSE
WHAT IS MANES LIFE BVT VAYNE VNPERFECTNES
HOW SWIFTLIE RVNE WE TO OVR FATALL ENDE
WE HAVE NO HOPE IF DEATH BE NOT OVR FRENDE
I SKERNE DOE SHEW THAT ALL OVR EARTHLIE TRYSTE
ALL EARTHLIE FAYERS AND GOODS AS WEE ARE DVST
LOOKE ON THE WORDLES INSYDE AND LOOKE ON ME
HER OVTSYDE IS BVT PAINTED VANITIE.
ERECTED AND FINISHED BY MARGARETT SKERNE
HIS WIFE WHICH CAVSED THIS WORKE TO BEE
MADE ANNO DNI 1596.

4. SKERNE.

Below is the following inscription in Roman type :—

"IF EACH THINGS END DOE EACH THINGS WORTH EXPRESSE,
WHAT IS MANES LIFE BUT VAYNE VNPERFECTNES
HOW SWIFTLIE RVNE WE TO OVR FATALL ENDE
W^{CH} HAVE NO HOPE IF DEATH BE NOT OVR FRENDE
I SKERNE DOE SHEW THAT ALL O^R EARTHLIE TRVSTE
ALL EARTHLIE FAYERS, AND GOODS & SWEETES ARE DVST,
LOOKE ON TH WORLDES INSYDE AND LOOKE ON ME
HER OVTSYDE IS BVT PAINTED VANITIE."

ERECTED AND FINISHED BY MARGARETT SKERNE, HIS WIFE WHICH CAVSED THIS WORKE TO BEE MADE ANNO DOMINI 1596.

Biographical Notes.—The family of Skerne trace descent from a younger branch of the Kings of Castile and Leon (Coker, p. 109). In 36 Hen. VI. Robert Skerne held the manor of Whitwell in Winterborne Kingston of the King (Esch. 37 Hen. VI., No. 3), Thomas, his son and heir, being 23 years old. Thomas Skerne died 1 Ed. IV.; Henry, his brother and heir, aged 12. At the time of his death he held the premises of the King by the 20th part of a Knight's fee; Henry, brother of Thomas, died 12 Ed. IV., leaving Henry, his son and heir, four years old.

Henry Skerne died 15 Henry VII.; Edmund, his son and heir, died 5 Hen. VIII. The family continued at Winterborne Kingston till about 1596, when nothing more is heard of them (Hutchins).

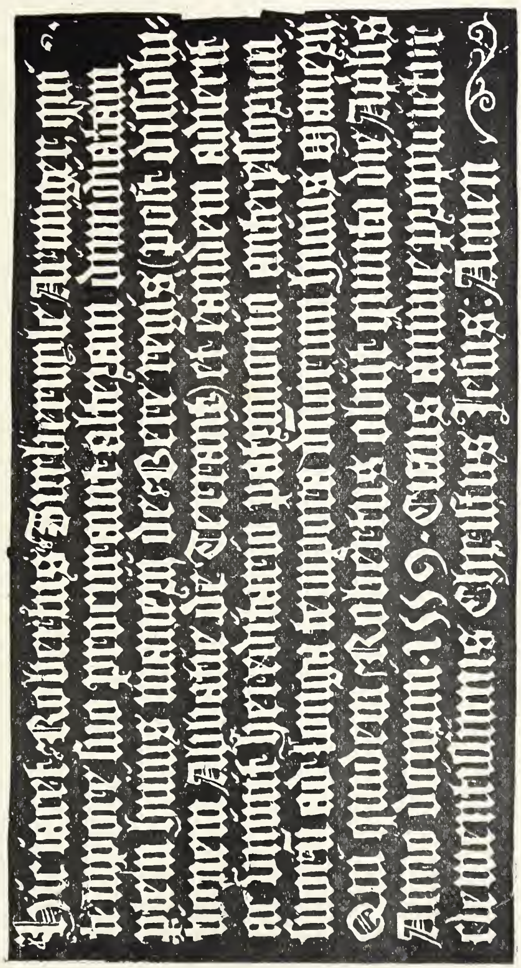
(5.) BERE REGIS ST. JOHN'S,

TURBERVYLE.

This brass is not mentioned by Haines.

Position.—On a stone slab at eastern end of south aisle.

Size.—18¼in. by 9¾in.



5. Robertus Turbervyle (Armiger).

Description.—Rectangular, having marks in the side, rather leading one to suppose another may have joined it formerly. The inscription is well cut in Old English characters of the period and is as follows :—

"Hic iacet Robertus Turbervyle, Armiger, qui tempore suo procuravit alteram dimidiatam partem huius manerii de Bere regis (post dissolutionem Abbatie de Terrant) et eandem adiecit ac univit hereditario patrimonio antecessorum suorum ad longa tempora dominorum huius manerii. Qui quidem Robertus obiit quinto die Aprilis, Anno domini 1559, Cuius anime propicietur clementissimus Christus Jesus. Amen."

Biographical Notes.—Robert Turberville, Esq., son and heir of George Turberville, and Audrey, his wife, daughter of Robert Matthew, Lord Mayor of London, traced his descent from John Turberville, of Bere, Knight, temp. Hen. III. He married Mary, daughter of Roger Mawdley, of Nunny, co. Somerset, and died 1559. He had issue Magdalene, who married Roger Newburgh, of Berkeley, co. Somerset, and Thomas Turberville, son and heir, who married Thomasin, daughter of Sir Robert Fitz-James, of Redlinch, co. Somerset, Knight, and ob. 1787, s.p. Arms, ermine, a lion rampant, crowned, gules. (MS. Dorset County Museum.) Crest, a castle argent.

Johannes Turbervill de Beere, vicecomes, Anno primo, Edwardi II. (and his namesake in the reign of Richard III.), bore—Argent, a lion rampant, gules, crowned or.—See Note Book of Tristram Risdon and Baring Gould's Armory of the Western Counties.

At Bere there are the remains of three altar tombs, all having empty matrices, besides despoiled floor slabs ; two of the former are in the south aisle, and may be assigned to this important old Dorset family, now, alas, of the past.

Report on First Appearances of Birds, Insects, &c., and the First Flowering of Plants

IN DORSET DURING 1901.

By NELSON M. RICHARDSON, B.A., F.E.S.

THE names of those who have this year sent in returns are as follows; they are denoted in the Report by initials:—

(J. C. M.-P.) J. C. Mansel-Pleydell, Whatcombe, near Blandford.
(N. M. R.) Nelson M. Richardson, Montevideo, near Weymouth.
(E. R. B.) E. R. Bankes, Norden, Corfe Castle.
(H. J. M.) H. J. Moule, Dorchester.
(E. S. R.) E. S. Rodd, Chardstock House, Chard.
(G. H.) G. Hibbs, Bere Regis.
(D. C.) D. Curme, Childe Okeford, near Blandford.
(S. C.) S. Creed, Coombe Farm, Sherborne.
(W. H. D.) Rev. W. Hughes D'Aeth, Buckhorn Weston Rectory, Wincanton.

In this section, as indeed in all others in the Club, we have sustained a great and irreparable loss in the death of our late President in May, 1902. His records were always wonderfully full, and, more often than not, earlier than those of any other observer. He loved the animals and plants, and nothing seemed to delight him so much as watching their ways and

habits. I could wish that every observer would look back at the records made by him in past years and endeavour, in this as in many other respects, to tread somewhat in his footsteps.

Some new observers are much wanted, as 9 or 10 are hardly sufficient to represent the county, even though, as at present, they are fairly evenly distributed. Very little scientific knowledge is required, and a great interest is added to country walks. One of the most regular observers for many years, Rev. O. P. Cambridge, has this year sent no return, as having been unable to visit the localities where his observations have usually been taken, he felt rightly that those taken elsewhere would be misleading. I would emphasise the importance of selecting the same small locality year after year for the observation of the same plant, and in the case of shrubs and trees it is even best to keep to the same individual, as even in the same hedge there will be great variations in the date of flowering.

Notes on Rare and other Birds in 1901.

Pied Wagtail (*Motacilla lugubris*).—This is only a partial migrant, some individuals remaining with us through the winter. One was feeding on Jan. 9 and succeeding days on the lawn at Montevideo, Chickerell, with other birds on bread, raisins, and medlars. (N. M. R.)

House Martin (*Chelidon urbica*).—First seen Ap. 28 at Corfe Castle. (E. R. B.)

Hoopoe (*Upupa epops*).—Seen at Norden, Corfe Castle, by A. E. and E. R. Bankes on Ap. 25. (E. R. B.)

Grasshopper Warbler (*Locustella nævia*).—First heard at Corfe Castle on Ap. 27. (E. R. B.)

Bittern (*Botaurus stellaris*).—Shot at Merley, near Canford, by E. Christopher, one of the Canford gamekeepers, during the winter of 1900-1 and recorded in the *Dorset County Chronicle*. (E. R. B.)

Brown Owl (*Strix aluco*).—One found sitting on her nest in a hollow oak tree at Chardstock on Mar. 9. (E. S. R.)

Nightingale (*Daulias luscinia*).—From six nests observed near Bere Regis, spread over a considerable area, 28 young were reared.

A hen was observed sitting on 4 eggs on May 13; the young hatched May 27 and left the nest on June 7. They leave early, and the season, being very dry, was favourable to them. (G. H.)

THRUSH (*Turdus musicus*), &c.—Thrush's nest with 4 eggs at Bere Regis on Mar. 11. (G. H.)

SKYLARKS, BLACKBIRDS, AND THRUSHES sang beautifully through October. (S. C.), SHERBORNE.

SNIPE (*Gallinago cœlestis*).—Male bird heard on Mar. 10 in his swift descent—an early date for this. The peculiar sound is termed in some districts "summer lamb," "moor lamb," or "heather bleat." A nest with 3 eggs on May 3. (G. H.), BERE REGIS.

RING OUZEL (*Turdus torquatus*).—One seen on Feb. 9. (D. C.), CHILDE OKEFORD.

WOOD PIGEON (*Columba palumbus*).—Heard cooing in Honeycombe Wood, Sherborne, on Jan. 16. (S. C.)

ROBIN (*Erithacus rubecula*).—About the middle of March one was seen in Coombe Lane, near the second milestone from Sherborne on the Marston Road, which, when flying, looked yellow or dirty white, but, on closer inspection, was found to be yellow with the natural colour showing through the yellow, especially the red about the throat and breast; it has been mistaken for a canary. It was not observed for the 15 days ending Ap. 26, and was probably sitting. On May 9th its nest was found, containing four young ones nearly fledged and all of the natural colour. It was last seen the third week in June ¼ mile from Coombe Farm, going S.W., having come from the N.E. (S. C.)

SPARROW (*Passer domesticus*).—A brownish yellow variety (believed to be this species) amongst a large flock chiefly composed of sparrows and linnets. (S. C.)

STARLING (*Sturnus vulgaris*).—A nest of young starlings left their nest in the roof of my house two days before Christmas Day, 1901. (W. H. D.), (BUCKHORN WESTON).

ROOK (*Corvus frugilegus*),—During April several rooks constantly frequented my lawn at Norden, near Corfe Castle, the great attraction being obviously the bulbs of the common buttercup (*Ranunculus bulbosus*) upon which they fed largely. Although they were often closely watched while feeding on the

lawn I never saw them eat anything but buttercup bulbs, which they dug up with great zest and vigour, and the evidences they left behind them told the same tale, for beside each of the numbers of conspicuous holes made by their powerful beaks, was to be found an uprooted buttercup plant, of which the bulb alone was missing. (E. R. B.)

NOTES ON REPTILES.—On April 28th, I captured a fine melanic variety of the Viviparous Lizard (*Zootica vivipara*) on Knowle Hill near Corfe Castle. (E. R. B.)

July 8th, killed a Common Grass Snake while haymaking on the lawn here. In 29 years, living at Chardstock House, I have only seen three or four snakes and never a viper. There is no spring of water above ground nearer than half a mile straight from Chardstock House, &c., situated *on the chalk*. (E. S. R.)

NOTE ON INSECT.—A Herald Moth (*Gonoptera libatrix*) began to hibernate in an outhouse at Montevideo, near Weymouth, in October, 1900, where it remained sitting on the wall until the night of April 2nd, 1901, when it flew away. (N. M. R.)

BOTANICAL NOTES.

WEYMOUTH.—Buttercup in flower March 16th. (N. M. R.)

DORCHESTER.—As far as I remember, the leaves never clung so perseveringly to the trees as in the autumn of 1901. A group of 9 or 10 trees, mostly elms, was sketched on November 2nd, with nearly a full show of leaves on almost all of them. (H. J. M.)

CHILDE OKEFORD.—Brambles have not lost their leaves or changed colour this year. (D. C.)

SHERBORNE.—Honeysuckle had been in leaf a fortnight on January 1. Scarcely any more growth took place until April 1. (S. C.)

GENERAL NOTES.

Mr. E. S. Rodd, of Chardstock House, Chard, sends the following note on the weather generally :—

On the evening of June 25th, a sun column or pillar was observed by me at *Chardstock House*, between 8 and 9 p.m. This was the first I ever saw, and it was a remarkable and beautiful phenomenon. The day had been very *hot and bright*. There

was a considerable drought throughout the South of England during April, May, till the middle of June, terminating on the night of 29th—30th, in a tremendous thunderstorm, accompanied with torrents of rain, much needed for everything except the hay.

A remarkably changeable November and December for weather.

December 12th, very heavy rain fell, the country flooded. Seven inches *of rain* fell, and was registered at *Tatworth* Vicarage, 1 mile from Chardstock House.

December was one of the wettest months for the year. *Yet*, the rainfall is *below* the average, owing to the *general dryness* of the seasons the last 2 or 3 years.

December 27th was clear, bright, and a hard frost. December 28th was a most complete and sudden contrast, and it was one of the wettest days I ever remember. I was out hunting all day with the Cattistock Hounds. The country flooded and washed out.

About November 5th (?) a very beautiful meteor was observed at Chardstock and throughout the South of England. (E. S. R.)

I insert, with hesitation, on account of the improbability of the correctness of the records, owing to the rarity of the occurrences, the two following notes by Dr. Curme :—

1. A nightjar was heard singing on Jan. 1 by Mrs. and the Misses Curme.

I can find no similar record of a nightjar in winter, and cannot help thinking it to be an error.

2. A Mazarine blue butterfly (*Lycæna acis*) was seen on August 1st by Mrs. Curme and by the late Surgeon-Col. Archer, Dr. Curme's brother-in-law, whom he states to have been "a very good naturalist, a competent observer, and moreover a butterfly collector, and he drew attention to the underwings, and he also remarked that he had not seen one in England for many years."

This, if reliable, would be a most interesting observation, as the butterfly has been considered practically extinct in England for many years, no captures having been recorded. But "blue butterflies" much resemble each other, and unless actually caught, which would surely have been done if practicable in this case by a butterfly collector, such a record is in my opinion much in need of confirmation.

Earliest Dorset Records of Plants in Flower in 1901.

		Dorset.	J. C. M.-P. Whatcombe.	N. M. R. Weymouth.	E. R. B. Corfe Castle.	E. S. R. Chard.	H. J. M. Dorchester.	G. H. Bere Regis.	D. C. Childe Okeford.	S. C. Coombe Farm, Sherborne.	W. H. D. Buckhorn Weston.
Wood Anemone ..	..	Mar. 25	Mar. 25	April 11	Ap. 9	Ap. 15	..	..	Ap. 9	Ap. 26	Mar. 27
Lesser Celandine ..	..	Jan. 16	Feb. 18	Mar. 16	..	..	..	Mar. 4	Feb. 1	Jan. 16 (5)	Mar. 6
Marsh Marigold ..	..	Mar. 22	Mar. 22	Ap. 22	Ap. 12	Ap. 29	Ap. 6	..	Ap. 5	Ap. 23	Ap. 15
Dog Violet	..	Mar. 19	Mar. 19	Ap. 18	..	Ap. 25	..	..		Ap. 24	Ap. 16
Greater Stitchwort ..	..	Ap. 5	Ap. 5	Ap. 18	Ap. 22 (2)	..	Ap. 20	..	Ap. 19	Ap. 13	Ap. 16 (8)
Herb Robert	..	Ap. 19	Ap. 19	May 11	May 2	Ap. 29	..	..	..	May 20	May 5
Horse Chestnut	Leaf ..	Ap. 9	..	Ap. 16	..	Ap. 19	Ap. 10	..	..	..	Ap. 9
	Flower	Ap. 30	May 13	May 11	..	..	May 7	..	Ap. 30	(6)	May 8
Bush Vetch	..	Ap. 25	May 6	May 20	May 3	..	..	..	..	May 19	Ap. 25
Black Thorn	..	Ap. 11	Ap. 22	Ap. 11	Ap. 18	April	Ap. 20	..	Ap. 23	Ap. 13 (6)	Ap. 21
Hawthorn ..	Leaf ..	Ap. 8	..	..	..	..	..	...	Ap. 8	Ap. 26	
	Flower	May 2	May 2	May 15	May 16	..	May 23	..	May	May 17	May 17
Ivy	..	Oct. 1	Oct. 2	..	..	..	..	..	..	Oct. 1	
Dogwood	..	June 6	June 13	June 8	June 23	..	June 17	..	..	..	June 6
Elder	Leaf ..	Jan. 1 (6)	Ap. 29	Feb. 16	..	..	Jan. 23	..	..	Jan. 1 (6)	Ap. 7
	Flower	May 25	June 10	May 25	May 31	..	..	..	..	May 28	May 28
Wild Teasel	..	July 14	July 14	..	..	..	..	..	Aug 3	(6)	
Devil's-bit	..	June 28	Aug. 13	..	..	..	..	..	..	June 28	
Knapweed	..	June 7	June 7	June 21	June 19	..	..	..	..	June 24	June 13
Field Thistle ..	Leaf ..	Mar. 15	..	..	..	..	..	..	..	Mar. 15	
	Flower	June 7	June 7	June 29	June 30	..	..	..	..	July 6	June 13

EARLIEST DORSET RECORDS OF PLANTS IN FLOWER IN 1900 *(continued.)*

	Dorset.	J. C. M.-P. Whatcombe.	N. M. R. Weymouth.	E. R. B. Corfe Castle.	E. S. R. Chard.	H. J. M. Dorchester.	G. H. Bere Regis.	D. C. Childe Okeford.	S. C. Coombe Farm. Sherborne.	W. H. D. Buckhorn Weston.
Coltsfoot	Feb. 21	Feb. 21	Ap. 3 *	..	..	..	..	Ap. 4	Mar. 15	Mar. 7
Yarrow .. .. Leaf ..	Jan. 31	..	..	..	..	..	..	Jan. 31		
Yarrow Flower	June 17	June 24	June 25	July 2	..	..	..	..	July 3	June 17
Ox-eye Daisy	May 15	May 15	June 6 *	May 17	..	..	..	..	May 24	May 22
Mouse-ear Hawkweed ..	May 20	May 20	May 28	..	..	..	..	..	June 16	May 23
Harebell	June 21	June 21	..	June 30						
Greater Bindweed Leaf ..	Ap. 30	..	..	..	..	..	..	..	Ap. 30	
Greater Bindweed Flower	June 16	June 16	July 6	..	..	July 10	..	..	June 27	June 21
Water Mint	Aug. 15	Aug. 16	..	..	..	..	..	Aug. 15		
Ground Ivy .. Leaf ..	Feb. 1	..	..	..	..	..	..	Feb. 1		
Ground Ivy Flower	Mar. 17	Mar. 17	Ap. 18	Ap. 18	..	Ap. 26	..	Ap. 4	..	Mar. 17
Wych Elm .. Leaf ..	May 3	..	..	..	..	May 3				
Wych Elm Flower	Feb. 28	Feb. 28	Ap. 4							
Hazel (Red Female Flower)	Jan. 20	Jan. 22	Jan. 20 (1)	..	..	..	Mar. 21	Mar. 8	Ap. 13	Feb. 8
Cowslip	Ap. 1	Ap. 6	Ap. 18	Ap. 15	Ap. 18 (3)	..	Ap. 25	..	Ap. 13	Ap. 1
Spotted Orchis	Ap. 20	Ap. 20	May 4	..	..	..	May	..	(6)	June 5
Bluebell	Ap. 7	Ap. 7	May 4	Ap. 23	Ap. 27	..	..	Ap. 10	May 10 (7)	Ap. 17

* Had been in flower some time. (1) Had been in flower before, but cut by frost (N. M. R.). (2) Stitchwort in flower at Langton Matravers on Ap. 10 (E. R. B.). (3) Picked a cowslip in flower Nov. 5 near Chardstock (E. S. R.). (4) Bush Vetch in flower June 4; Elder June 1, both at Swanage (H. J. M.). (5) One Celandine flower on Jan. 16; no others seen until Mar. 7 (S. C.). (6) Coombe Farm, Sherborne. No Horse Chestnut, Teasel, or Spotted Orchis flowers seen, and hardly any Blackthorn. Elder had been in leaf since the middle of December, 1900 (S. C.). (7) Bluebell in flower Ap. 23 at Silverlake (S. C.). (8) One stray piece on Mar. 26. The general flowering began Ap. 16 (W. H. D.).

First Appearances of Birds in Dorset in 1901.

	Dorset.	J. C. M.-P., Whatcombe.	N. M. R., Weymouth.	E. R. B., Corfe Castle.	E. S. R., Chard.	G. H., Bere Regis.	D. C., Childe Okeford.	S. C., Coombe Farm, Sherborne.	H. J. M., Dorchester.	W. H. D., Buckhorn Weston.
Flycatcher ..	Ap. 21	Ap. 21	May 14	..	..	..	..	May 24	..	May 22
Fieldfare ..	Nov. 23	Dec. 10	..	..	..	..	Nov. 23	Dec. 1		
Blackbird	Mar. 7 N.	Mar. 7 N.	..	..	..	..	..	Mar. 30 N.		
	Mar. 14 E.	..	..	Mar. 14 E. (2)	..	..	..	Ap. 7 E.		
Redwing ..	Jan. 2	Jan. 2	..	..	Mar. L.					
Nightingale	Ap. 10 S.	Ap. 20 S.	May 4 S.	Ap. 29 S.	Ap. 24 S.	Ap. 10 S. (3)	Ap. 14 S.	May 24 S.	..	Ap. 25 S. (8)
	May 8 E.	..	..	..	..	May 8 E.				
Wheatear ..	Mar. 30	Ap. 3	Ap. 11	..	..	..	..	Mar. 30		
Willow Wren	Ap. 12 S.	Ap. 12 S.	..	..	..	..	..	..	..	Ap. 20
	July 1 N.	..	..	..	..	..	..	July 1 N.		
Chiff-chaff	Ap. 2	..	Ap. 2	..	..	..	..	..	..	Ap. 13
	Mar. 31 S.	Ap. 11 S.	Ap. 12 S.	Ap. 15 S.	Mar. 31 S.	Ap. 8 S.	Ap. 5 S.			
Whitethroat	Ap. 12	Ap. 29	Ap. 12	Ap. 24	..	..	..	Ap. 24		
	Ap. 24 S.	..	..	Ap. 24 S.						
Skylark ..	Jan. 3 S.	Jan. 3 S.	Feb. 18 S.	..	..	Feb. 12 S.	Feb. 11 S.			
Rook	Jan. 1 N.	Feb. 4 N.	..	..	..	..	Jan. 1 N.	..	..	Feb. 5 N.
Cuckoo	Ap. 6.	..	..	Ap. 19	..	..	Ap. 6	..	..	Ap. 20 (8)
	Ap. 10 S.	Ap. 13 S.	Ap. 30 S. (1)	..	Ap. 19 S.	Ap. 10 S.	Ap. 18 S.	Ap. 25 S.		
Swallow	Ap. 7	Ap. 18	Ap. 18	Ap. 18	Ap. 18	Ap. 7 (4)	Ap. 18	Ap. 13	Ap. 12	Ap. 18 (9)
	Oct. 28 L.	Oct. 26 L.	Oct. 27 L.	..	..	Oct. 28 L.				
Sand Martin	Ap. 8	Ap. 8	..	..	..	..	Ap. 23	Ap. 23		
Swift ..	May 1	May 4	May 14	May 6	..	May 1	May 6	May 6	..	May 13
	Sep. 14 L.	..	Sep. 14 L.	..	..	Sept. 9 L.				
Nightjar	Ap. 26	..	..	Ap. 26						
	May 4 S.	May 13 S.	May 4 S.	..	..	..	..	May 22 S. (5)		
Turtle Dove ..	Ap. 22 S.	Ap. 25 S.	May 4 S.	..	Ap. 22 S.	..	..	May 9 (6)		
Woodcock	Nov. 16	..	..	..	..	..	..	Nov. 16		
	Mar. 9 L.	Mar. 9 L.								
Corncrake ..	Ap. 30 S.	May 18 S.	Ap. 30 S.	..	..	..	May 4	..	..	June 7
Wryneck ..	Mar. 26 S.	..	Mar. 26 S.	Ap. 18	..	May 5 S.	..	Ap. 23 (7)		

N. Nesting. E. First Egg. S. Song first heard. L. Last seen or heard.

(1) Cuckoo heard at Weymouth by Captain Rickards Ap. 24. (2) Abnormally early for such a late spring (E. R. B.). (3) Nightingale in full song at Bere Regis Ap. 12; nesting May 5 (G. H.). (4) Several swallows at Bere Regis on Ap. 15 (G. H.). (5) Near Poyntington; nightjar never heard at Coombe Farm (S. C.). (6) Particularly plentiful. (7) At Compton (S. C.). (8) Nightingale and cuckoo a fortnight later than usual (W. H. D.). (9) Swallow at least ten days later than usual (W. H. D.).

First Appearance of Insects, &c., in Dorset in 1901.

	Dorset.	J. C. M.-P. Whatcombe.	N. M. R. Weymouth.	E. R. B. Corfe Castle.	H. J. M. Dorchester.	E. S. R. Chard.	G. H. Bere Regis.	J. C. Childe Okeford.	S. C. Coombe Farm, Sherborne.	W. H. D. Buckhorn Weston.
Rose Beetle	June 25	June 25								
Cock-chafer	May 28	May 30	..	..	..	..	July 1	..	May 28 (5)	
Fern Chafer	July 1	July 1								
Bloody-nose Beetle.. ..	Mar. 12	Mar. 25	..	..	..	..	..	..	Mar. 12	
Glow-worm	June 5	June 5	June 30	..	..	..	June 6	..	July 16 (5)	June 28
Common Hive Bee (*h*) ..	Feb. 25	Feb. 26	Feb. 25	..	Ap. 1	..	..	Ap. 12	Mar. 16	
Wasp (*h*)	Jan. 22	May 2	Ap. 30 (1)	Ap. 23	..	(4)	July 6 (6)	Jan. 22	July 15 (5) (6)	
Large White Butterfly ..	Mar. 12	Mar. 12	May 18 (2)	Ap. 23	..	..	..	..	Mar. 12	Ap. 22
Small White Butterfly ..	Mar. 12	Mar. 12	Ap. 19 (2)	Ap. 21	Ap. 23	..	..	..	May 12	Ap. 17
Orange-tip Butterfly ..	Ap. 20	Ap. 20	May 24	May 25	..	..	..	..	May 22	Ap. 27
Meadow-brown Butterfly..	June 9	June 22	June 10	June 21	..	..	..	..	June 20	June 9
Wall Butterfly	May 25	July 2	May 28	May 25	..	..	..	..	..	June 2
Brimstone (*h*)	Mar. 11	Mar. 12	Ap. 24	Ap. 17	..	March	Mar. 12	..	Ap. 17	Mar. 11
Painted Lady (*h*)	Ap. 19	Ap. 23	..	..	..	Ap. 19	..	..	..	May 10
Cinnabar Moth	May 26	May 26	June 14	June 10 (3)						
Currant Moth .. .	June 1	June 1	July 2	..	..	..	..	..	..	July 12
Viper (*h*)	Mar. 7	Mar. 7	..	Ap. 24						
Frog Spawn	Feb. 13	Feb. 13	..	..	..	..	Feb. 14	..	Mar. 5	

h = hibernated specimen.

(1) Queen wasps fairly common both in spring (*h*) and autumn, but workers very scarce, only one or two having been seen, one on Nov. 17 (N. M. R.). (2) Very abundant (N. M. R.). (3) Had been out some time, a few specimens being already worn. (4) A wasp flying about near Hawkchurch on Nov. 22. (5) Very scarce. (6) Doubtless the specimen recorded was a worker, not a hibernated female (N. M. R.)

INDEX TO VOLUME XXIII.

By E. W. YOUNG.